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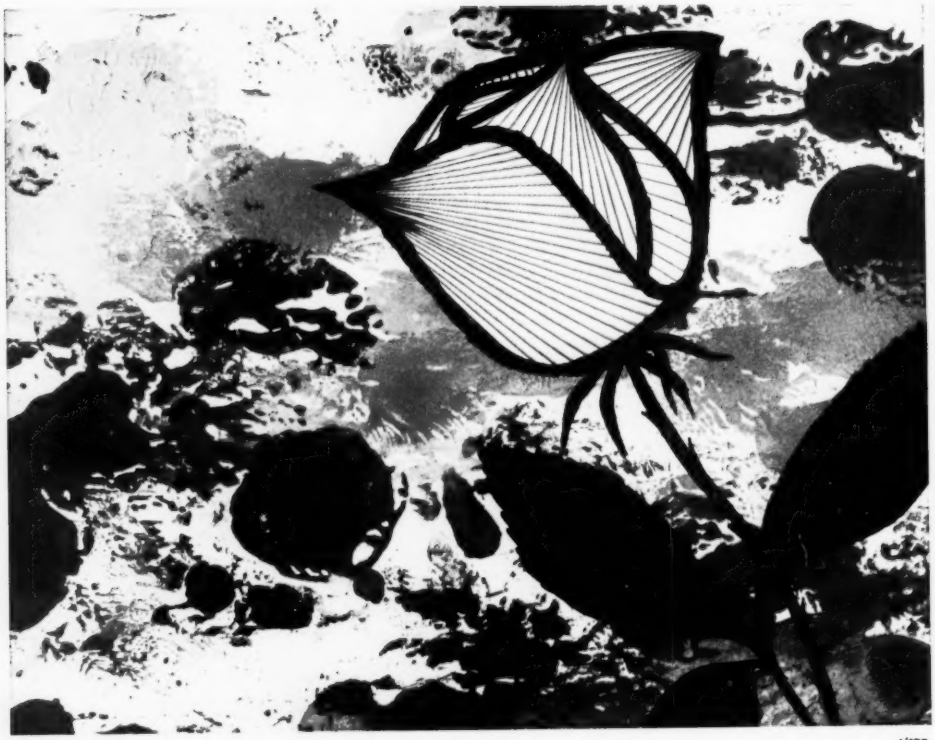

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AMERICAN

DYESTUFF REPORTER

Volume 49 October 31, 1960 No. 22

REACTION OF COTTON CELLULOSE WITH EPOXIDES IN THE PRESENCE OF ACID CATALYSTS

JOHN B McKELVEY, BEVERLY G WEBRE and RUTH R BENERITO

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New Orleans, La

Ease of reaction of cellulose and various available epoxides in the presence of hydrogen ion catalysts and Lewis acids is considerably different than results obtained previously with base catalysis. Only a few monoepoxides add to cotton in the presence of cold dilute mineral acid and in the case of ethylene oxide, the addition being about 10% of that obtained in the presence of hydroxyl ion. Diepoxides tested were also rather inert in the presence of hydrogen ion; the best (butadiene diepoxide) adding to cotton only about half as much as the best monoepoxide (butadiene monoepoxide).

Under conditions of cationic catalysis (Lewis acid), especially with zinc fluoborate, it has been found that only two monoepoxides react with cotton. In the case of diepoxides, some of which are known to be very active, it was shown that crease resistance may be imparted to cotton at very low add-on by butadiene diepoxide, and that several diepoxides tested while producing good enough add-on failed to impart dry crease resistance.

When expoxides which are known to add to cotton by zinc fluoborate catalysis are reacted under optimum conditions of base catalysis, it was found that the base-catalyzed samples exhibited only good wet crease resistance.

INTRODUCTION

ALTHOUGH the literature contains numerous references to acid-catalyzed reactions between many epoxides and simple alcohols or phenols (*1,17*), there is little information on the cellulose-epoxide reaction in the presence of acids-organic or mineral. The only source of such information is in the patent literature (*2,18,19,21*) and this literature is not really concerned with hydrogen ion, but rather with cationic catalysts or Lewis acids. This paucity of information is not surprising in view of the well-known effects of acids on cellulose, since there is the danger of concentration on drying in the fiber with resultant degradation of the cellulose. Many of the weaker organic acids, when concentrated and cold, have little action other than rendering cellulose hydroxyls more accessible by decreasing hydrogen bonding (*20*), though it has been shown that formic acid indeed reacts to a slight extent (*15*). Since the use of cold concentrated mineral acid is out of the question, only cold and dilute solutions of such acids are of interest to this work. However, latent catalysts, such as fluoborates, sulfates, and perchlorates, in the form of certain metallic salts have been suggested (*2,18,23*) in the patent literature. While these catalysts are acidic in aqueous solution, their utility does not arise from such considerations but rather to the decomposition products formed when the metallic salt is heated. It should be noted that the several authors (*18,21,23*) point out only *certain* metal salts which are easily decomposed are useful.

However, one objective of the present work was to ascertain the effect of *hydrogen ion* (H^+) on cellulose-epoxide reactions at room temperature using common epoxy compounds. It was reasoned that a good starting point would be experiments similar to those performed by Lawrie (*9*) with the simplest epoxide, ethylene oxide. Lawrie reported the effects of base catalysis on carbon tetrachloride solutions of ethylene oxide, and the fact that the epoxide will add to cotton from a neutral brine solution, but curiously, mentioned no acid catalyzed system even at 25°C.

cotton from a neutral brine solution.

Dreyfus (*3*) in 1934 reported a reaction between cotton linters and ethylene oxide at temperatures of 120-160° with consequent pressures of 10-20 atmospheres in the absence of alkali. For acid catalysis, acetic acid or bisulfite was preferred over sulfuric acid because of the degradative effect of the latter.[2]

Secondly, a study was needed to find out which of the other common epoxides will add to cotton under (H^+) acid conditions, since epoxides were found to differ greatly among themselves in reactivity to cotton in the presence of hydroxyl ion (OH^-) (*12*).

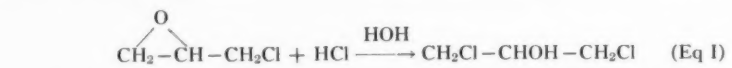
Finally, some comparison of the various methods of catalysis including all types of acid catalysts was deemed necessary especially in regard to production of cotton with high crease resistance.

In the case of acid catalysis of epoxides in general, there are certain fundamental difficulties involved in their experimental handling. That is, bulk epoxides are frequently extremely sensitive to acids and may polymerize, react exothermically, and char the cellulose. For example, yarn containing a 0.1% solution of sulfuric acid will cause styrene oxide to react and char the cotton. This difficulty can be overcome to some extent by the use of solvents and this method has been used in the majority of experiments reported in the present work. Furthermore, one might expect many of the simple epoxides es-

[1]One of the laboratories of the Southern Utilization Research & Development Division, Agricultural Research Service, US Department of Agriculture.

[2]In a private communication from N R Eldred of Union Carbide Chemicals Co, our attention has been called to the Dreyfus patent (*3*) as well as earlier German patent 363,192 (Nov 4, 1922) which states that the weight of cotton is increased when reacted with ethylene oxide under pressure at 100°C. Dr Eldred further reported that this work was confirmed by A E Broderick (UCC) but only limited weight gains were obtained.

pecially in aqueous solution to form well-known epoxide derivatives. For example, epichlorohydrin and hydrochloric or other acids react according to the following equation:



$$CH_2-CH-CH_2Cl + HCl \xrightarrow{HOH} CH_2Cl-CHOH-CH_2Cl \quad \text{(Eq I)}$$

It will be recalled that several methods of determination of oxirane oxygen depend on absorption of mineral acids such as HCl or HBr (*4*) by the epoxide and *a priori* one might consider a reaction such as cellulose and an epoxide by H^+ as impossible since the catalyst would be consumed in formation of a simple epoxide derivative.

EXPERIMENTAL

CHEMICALS——All of the epoxides except four were research grade materials kindly furnished by the various sources listed in Table II[2]. The epoxide equivalents of the various epoxides were determined by the method of Durbetaki (*4*).

The diepoxy stearic acid and methyl epoxy stearate were prepared in the Industrial Crops Laboratory of this Division. The diglycidyl ether of 1,4-butanediol was fractionated from Araldite RD-2 as that portion distilling between 120-130° at five millimeters. It was found to have an oxirane oxygen content of 15.63% by the method of Durbetaki (*4*), and was therefore 98.7% pure. One sample of glycidol was a laboratory preparation.

METHODS —— The following simple test procedure was used for initial screening tests. A one-gram skein of a 7/2 mercerized yarn (Linker Machines, Inc)[3] was immersed in a solution of the acid catalyst, degassed under a bell jar for one-half hour, and centrifugally extracted. The wet yarn was placed in a small, round-bottom flask containing 20-25 ml of the epoxide or epoxide solution. The flask was agitated by a wrist-action shaker in a thermostatically controlled bath at the desired temperature. After the desired time had elapsed, the yarn was drained, washed with methanol, chloroform, or ether (depending on the solubility of the epoxide), and finally, washed with distilled water. Drying was carried out in a forced draft oven at 100-105°C or in a vacuum oven at 60-65°C.

[3]Trade names have been used to identify materials used in the work, and such does not imply endorsement or recommendation by the US Department of Agriculture over other products not mentioned.

When small swatches of 80 × 80 desized and scoured print cloth were used, a procedure similar to that described for the yarns was used, but the acid catalyst was applied by means of a small hand padding machine. Experiments were performed also with various acidic derivatives of cellulose prepared by members of the staff of this laboratory.

A 20% solution by volume of ethylene oxide in carbon tetrachloride was used according to Lawrie's method (*9*) at room temperature even though some of the ethylene oxide was lost by this method.

The method of Schroeder and Condo (*18*), which is based on the use of zinc fluoborate as catalyst, was modified as follows: Five grams of epoxide were dissolved in 45 ml methanol to which one milliliter of 40% zinc fluoborate solution was added. Methanol was selected as the common solvent because it is volatile, cheap and dissolves all epoxides thus far tested. A swatch of 80 × 80 print cloth was twice padded through the freshly prepared solution so that the wet pickup was 70-75%. The swatch was then cured in an oven for five minutes at 125°C instead of at 175-180°C as recommended by Schroeder and Condo because of the low boiling points of many of the epoxides. After the swatch was washed with methanol and water, it was ironed dry and equilibriated 24 hours before it was weighed.

When weight gains occurred, the modified cellulose products were treated with hot dimethylformamide in an ASTM extractor (of the type used in the rubber industry) in order to remove resins which were not combined with the cellulose, but formed by polymerization of the epoxide.

For an investigation of base catalysis under conditions similar to those used in acid catalysis, a swatch of 80 × 80 print cloth was padded twice with a 15% NaOH solution to approximately 90-100% wet pickup. It was then padded twice with a solution containing five grams of the epoxide in 45 ml of methanol. After curing five minutes at 125°C, it was washed in 1% HNO_3 before being washed in methanol and then in water. The swatches were ironed dry and weighed after a 24-hour equilibriation period. A similar series of applications were made in which the epoxide solutions were padded on first, and then the 15% NaOH solution was applied.

TABLE I
Effect of catalysts on cellulose-ethylene oxide reaction[a]

Catalyst	*Weight gain in 18 hours*
None	0.0
NaCl	7.5[d]
NH_4Cl	2.0
Acetic acid	0.0[d]
Citric acid	1.5
HCl	0.0
H_2SO_4	6.6[d]
$HClO_4$	4.4
Trifluoroacetic acid	3.3
HBF_4	7.1
$Zn(BF_4)_2$	1.6
BF_3· Dimethylformamide	6.8
Diethylaminopropylchloride hydrochloride[b]	0.0
NaOH[c]	74.0

[a] Cellulose yarn was steeped, de-aired in 5% by weight catalyst solution, centrifugally extracted to 125-175% wet pickup, and then treated with 20% by volume solution of ethylene oxide in CCl_4 at 25°C.

[b] Trade name of Michigan Chemical Corp acid catalyst[3].

[c] Cellulose product partially dissolved during purification process, and a completely water-soluble product was formed when 15% NaOH was used.

[d] 22 hours.

RESULTS AND DISCUSSION

ETHYLENE OXIDE-CELLULOSE REACTION —— Many theoretical discussions of epoxide ring opening with consequent addition to a reactant are based upon experiments performed with ethylene oxide in the presence of hydroxyl or hydrogen ion, since this compound may be considered as the parent epoxide from which all others are derived. In Table I, results for ethylene oxide and cotton cellulose reaction at 25°C are shown for various catalytic conditions covering a wide pH range.

While none of the acids used could be classed as a good catalyst in this reaction, there are nevertheless, certain differences in action among them. Acetic and hydrochloric—typical organic and inorganic acids—are without effect on the addition reaction. This does not mean that these acids are incapable of opening the oxirane ring; because frequently polymer can be seen on the walls of the reaction vessel, but the acids promoted no reaction with cellulose.

The two cationic catalysts, zinc fluoborate and the dimethylformamide complex of boron trifluoride are both quite acidic in aqueous solution (pH 1 or less by hydrolysis) and might be expected to function similarly to fluoboric acid but this was not realized experimentally. The formamide complex caused a greater add-on than did the zinc salt. Two other mineral acids, perchloric and sulfuric, resemble fluoboric acid in catalytic ability. Trifluoroacetic acid (a strong organic acid) which has been used as an impeller in some cellulose reactions has scarcely more effect than

TABLE II

Epoxides studied and weight gains effected by 1% sulfuric acid[a]

Epoxide	*Source*	*Epoxide equivalent*	*BP °C 760 mm*	*Weight gain % of cotton*
Alpha-pinene epoxide	Becco	0.58	102 (50mm)	—
Ethylene oxide	Eastman	—	10.4	2.0
Glycidol	Roberts	1.18	—	3.2
Glycidol	lab prep	1.33	81 (14mm)	—
Epichlorohydrin	Eastman	1.07	116	0.0
Allyl glycidyl ether	Shell	0.75	153	0.0
Phenyl glycidyl ether	Shell	0.74	245	0.0
Butyl glycidyl ether (Araldite RD-1)	Ciba	0.77	167	0.0
Butadiene monoepoxide	UCC	0.91	—	12.2
Butadiene diepoxide	UCC	2.34	138	6.3
Styrene oxide	UCC	0.63	194	6.4
Glycidyl methacrylate	DuPont	1.80	189	0.0
Dipentene oxide	Becco	0.55	113 (50mm)	0.0
1,4-dichloro 2,3-epoxy butane	UCC	0.70	192	0.0
Vinyl cyclohexene monoepoxide	UCC	0.84	169	0.0
Vinyl cyclohexene diepoxide	UCC	1.40	227	5.3
1,2-diisobutylene oxide	UCC	0.67	141	0.0
Epoxide 201	UCC	0.68	150 dec (10mm)	0.0
Eponite 100	Shell	0.76	270	1.1
Araldite RD-2	Ciba	0.97	270	1.0
Limonene diepoxide	UCC	1.17	242	2.6
Resorcinol diglycidyl ether	Koppers	0.79	solid	0.0
Isosorbide epoxy resin	Atlas	0.35	solid	—
Diepoxy stearic acid	lab prep	0.50	solid	—
Dicyclopentadiene dioxide	UCC	0.68	solid	—
1,2-epoxydecane	UCC	0.71	—	0.0
Methyl 9, 10-epoxy stearate	lab prep	0.32	solid	—
Bis-epoxydicyclopentyl ether of ethylene glycol	Rohm & Haas	0.50	240-50 (1mm)	—

[a] Cellulose yarn pretreated with 1% sulfuric acid and then 20% by volume of epoxide in CCl_4 for 24 hours at 26°C. (There were no add-ons when the epoxide was the inner phase).
[b] Equivalents of acid per 100 g epoxide.

TABLE III

Epoxides studied[a] and fabric properties

Compound	*Weight gain % of fabric*	*Crease angles (W+F) Dry*	*: Wet*
1) Epoxide 201	6.6	114	208
2) Vinylcyclohexane diepoxide	5.0	219	225
3) Butadiene diepoxide	1.7	291	254
4) Isosorbide epoxy resin	8.9	160	228
5) Araldite RD-2	(9.4	233	229
	(9.0[b]	262	283
6) Diglycidyl ether of 1,4-butanediol	10.9	280	266
7) Allyl glycidyl ether	(1.5	181	206
	(5.8[b]	205	261
8) Eponite 100	9.2	250	252
9) Resorcinol diglycidyl ether	5.3	169	222
10) Diepoxy stearic acid	4.8[b]	137	213
11) Glycidol	5.5	183	151
12) Glycidol (vacuum distilled)	5.8	183	157
13) Control	—	196	166

[a] Reaction conditions: Samples of 80 X 80 print cloth were padded twice with laboratory padder in solution of five grams epoxide in 45 ml methanol and one ml of 40% $Zn(BF_4)_2$, heated for five minutes at 125°C, and washed in methanol or chloroform and water.
[b] Cured at 150°C.

has weak citric acid, a tricarboxylic acid. The acids which catalyzed best are about equal in action to a neutral sodium chloride solution. It can be easily demonstrated that water-soluble epoxides cause a neutral sodium chloride solution to become quite alkaline. Probably, as the chloride ion opens the oxirane ring, the solution becomes more basic due to the following well-established reactions:

Hydroxyl ion (sodium hydroxide) is approximately ten times as effective as the best acid in promoting addition of the epoxide to cellulose. In fact, when 15% NaOH is used to catalyze the reaction, a water-soluble product is formed.

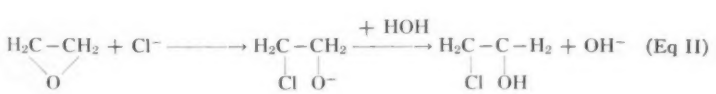
It was further observed that, when the yarn was removed from the reaction solution, it was often swollen with polymer formed from epoxide which had diffused into the aqueous layer. When the yarn was dropped into water, turbidity was observed. When no reaction occurred as with acetic acid or hydrochloric acid, this turbidity due to polymer was not visible. It would appear in these two cases that simple, water-soluble ethylene oxide derivatives had been formed.

Skeins which showed a weight gain were not appreciably affected by hot extraction with N,N-dimethylformamide as little or no add-on was removed. A fair interpretation of this result would be that, while the acid mostly causes polymerization or formation of a water-soluble simple derivative of the epoxide, there is a small fraction of activated epoxide which adds to the cotton and cannot be removed by solvents. This is not to be construed as positive chemical proof of a cellulose epoxide reaction because any alleged derivative would have to be hydrolyzed to known glucose ethers to prove the point. Conceivably, the add-on might be due to formation within the cotton fiber of polymer which is insoluble in solvents.

EFFECT OF H^+ ION CATALYSIS ——Fortunately, it has been shown recently in the case of the butadiene diepoxide cellulose reaction (*13*) that crease-resistant properties may be bestowed upon cotton fabric by either neutral salts, alkalis, or BF_3 (cationic) catalysts but not by hydrogen ion catalysis.

The first-mentioned catalysts produced high dry and wet crease resistance, while 1% sulfuric acid gave only wet crease resistance.

Using 1% sulfuric acid as a typical mineral acid (H^+) catalyst, a study was made with a number of epoxides listed in Table II. No epoxide tested gave a large add-on. The largest add-on of 12% was obtained with butadiene monoepoxide. This compound is only 4% by weight soluble in water and is known to be an example of abnormal ring opening (*8*). Moreover, it would not be expected to cross link due to its monofunctionality. As in the case of ethylene oxide, a number of epoxides listed in Table II formed low polymers in the yarn, which became stiff and sticky. The polymer formed in many instances washed out with methanol. This was particularly noticeable with phenyl glycidyl ether, the "acid catalysis" example of Schroeder and Condo (*18*). The weight gains listed in Table II were final weight gains after the product was washed with methanol and extracted in hot dimethyl formamide.

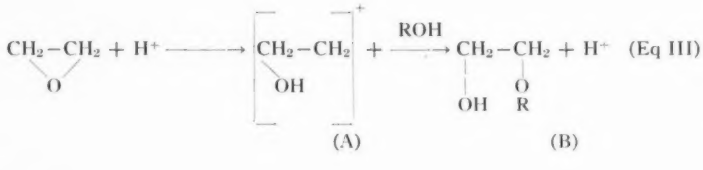


(Eq II)

When nonvolatile mineral acids, such as sulfuric, fluoboric, or perchloric, are substituted for latent catalysts, such as the fluoborates, in methanolic solution of diepoxides, which are known to add to cotton cellulose, such as Araldite RD-2, considerable heating occurs. If the temperature is increased to 150°C, the cloth is charred or irreparably damaged. Hydrochloric and acetic acids cause no add-on or charring under similar conditions. Citric acid and stannic chloride (cationic) do promote add-ons of 6% and 2% respectively. However, no dry crease resistance was imparted to the fabric; only mediocre gains in the wet crease angle were noted.

Therefore, it appears safe to assume that acid catalysis as represented by hydrogen ion is not a great factor in promoting add-on or crease resistance to cotton cellulose in the case of diepoxides because the action is too slow at temperatures which are permissible.

EFFECT OF CATIONIC OR LEWIS ACID CATALYSTS——Hydrogen ion has been shown on many occasions to open epoxide rings by formation of an active intermediate (A) which then may react with the solvent; for example, an alcohol to form an hydroxy ether (B).



(Eq III)

Similarly, boron trifluoride complexes are said to form active epoxy intermediates (*24,14,7*). However, in the simple cases cited, considerable abnormal addition, that is, addition contrary to Markownikoff's rule, was observed. The ethyl etherate of boron trifluoride is specifically mentioned as a catalyst, but this compound fumes in air and is too reactive with epoxides in solution for textile use. Hence, use was made of the zinc fluoborate catalyst of Schroeder and Condo (*18*). This and other metallic fluoborates generate boron trifluoride when heated at 75°C or above (*5,6*).

Every epoxide listed in Table II was reacted with cotton cellulose in the presence of zinc fluoborate as a catalyst.

A series of experiments using zinc fluoborate as catalyst was performed since it was found to be the best catalyst in preliminary screening experiments. In this series, the weight percent of the epoxide was varied from 10 to 20, and the weight percent of zinc fluoborate catalyst was varied from 2.5 to 10 based on the weight of of epoxide used. Curing temperatures varied from 100°C to 175°C, and the times of curing varied from three to five minutes. Optimum conditions were found to be in the range of 10-15% epoxide, 10% of catalyst based on the epoxide content, and 125°C curing temperature for three minutes. All solutions were freshly prepared and used immediately after addition of catalyst. The only epoxides which added to cotton cellulose in the presence of zinc fluoborate are listed in Table III along with the wet and dry crease angles imparted to 80 × 80 fabric by the respective weight gains. It will be noted first that only a few epoxides react with cotton in presence of zinc fluoborate as evidenced by weight gain. Furthermore, those given in Table III are diepoxides or are polyfunctional with the exception of allyl glycidyl ether and glycidol. Isosorbide epoxy resin was an experimental product of 5.6% oxirane content and of unknown composition, but presumably contained glycidyl ethers of sorbitol. It is further believed that glycidol and allyl glycidyl ether add by virtue of special properties of these molecules. Glycidol is known to react with itself when heated without benefit of catalysis (*10*). Allyl glycidyl ether may well polymerize through its double bond. In any event no dry crease resistance was imparted by glycidol, allyl glycidyl ether, or isosorbide epoxy resin, as noted in Table III.

TABLE IV
Crease angles obtained with base catalysis

Compound	Base catalysis — Method A[a] Weight gain % fabric	Crease angles (w+f) (Monsanto) Dry	Wet	Method B[b] Weight gain % fabric	Crease angles (w+f) (Monsanto) Dry	Wet
1) Butadiene di-epoxide	3.7	168	248	2.6	144	232
2) Isosorbide epoxy resin	3.5	147	247	9.6	151	266
3) Araldite RD-2	3.2	168	246	2.9	168	238
4) Allyl glycidyl ether	2.6	144	242	4.9	135	254
5) Eponite 100	5.5	180	253	4.6	155	245
6) Resorcinol diglycidyl ether	2.8	160	215	3.3	157	235
7) Glycidol[c]	6.1	158	216	4.1	139	220
8) Glycidol (vacuum distilled)	7.5	149	220	4.6	147	227
9) Vinylcyclohexene diepoxide	0	—	—	0	—	—
10) Epoxide 201	0	—	—	0	—	—
11) Glycidol	6.5	200	235			
12) Control	—	196	166			

[a] Reaction conditions: Samples of 80 X 80 print cloth padded 2X with 15% NaOH on laboratory padder; then padded 2X with solution containing 5 g epoxide in 45 ml methanol; heated five minutes at 125°C; washed in 1% HNO_3, methanol, then water; ironed dry and weighed 24 hours later.
[b] Similar to "a" but padded first with epoxide solution and then with base solution.
[c] 20% solution in $CHCl_3$ at 25°C for 30 minutes.

This would appear to prove that monoepoxides are not very reactive with cotton by the BF_3 activated intermediate mechanism mentioned earlier. If the mechanism is correct, one would expect to get add-on though not dry crease resistance with either styrene oxide or phenyl glycidyl ether, but this was not realized.

It can be seen further in Table III that little success has been obtained with any cyclic compound tested with the exception of vinylcyclohexane diepoxide. Such results might lead one to believe that cyclic compounds do not undergo reaction with cellulose, but positive results have been obtained with base catalysis (*12*).

COMPARISON WITH BASE CATALYSIS——It should be noted that many of the epoxides listed in Table II which are inactive with cellulose on acid catalysis are quite active with alkali cellulose (*12*). Therefore, for comparative purposes, those epoxides which added to cellulose in the presence of the zinc fluoborate catalyst at 125°C were tested under similar conditions of curing, but with base catalysis, and the results are given in Table IV. It can be seen from the data in Table IV that there were essentially no differences in the crease angles obtained with the two methods of base catalysis used, even though there were some instances of different weight gains. In all cases

TABLE V

Emulsion polymerization with acid catalysts on 80 x 80 cotton sheeting

Composition of emulsion	*Curing Conditions*	*% Add-on*
1) 10% Phenyl glycidyl ether .5% Tween 20 2% $Cd(BF_4)_2$ 40% solution 87.5% water	Drip dried, oven dried at 105-110°C, ironed at 180°C	22 after ironing 16 after water wash two after acetone extraction
2) 10% Epoxide 201 .5% Tween 20 88.5% water 1% Catalyst	Light squeeze, dried at 65°C, ironed at 180°C	10 with 1% $Zn(BF_4)_2$ 2.5 with .5% Zn $(BF_4)_2$ 4.0 with BF_3-$C_2H_5NH_2$ (all lost 50% of the gain in one water wash)
3) 10% Allyl glycidyl ether .5% Tween 20 88.5% water 1% $Cd(BF_4)_2$	Same as 1	6.3
4) 10% Epichlorohydrin .5% Tween 20 88.5% water 1% $Cd(BF_4)_2$	Same as 1	2.5
5) 10% Styrene oxide .5% Tween 20 88.5% water 1% $Cd(BF_4)_2$	Same as 1	6.8 (lost after water and solvent extractions)

where a weight gain was observed with alkaline catalysis, the dry crease recovery angles were lower than that of the control. The wet crease angles increased, but were essentially the same as those obtained on acid catalysis.

Improvements in dry crease angles were obtained with fluoborate catalysis and certain diepoxides. Data in Table III show that the monoepoxide, glycidol, imparts no wet or dry crease resistance. Another group of epoxides (diepoxy stearic, resorcinol diglycidyl ether, allyl glycidyl ether, Epoxide 201, and Isosorbide epoxy resin) improves the wet crease recovery angle by approximately 50° but lessens the dry crease recovery of the fabric. The only epoxides which improved both wet and dry crease angles were Eponite 100, Araldite RD-2, vinylcyclohexene diepoxide, butadiene diepoxide, and the diglycidyl ether of 1,4-butanediol, which is the principle component of Araldite RD-2.

Epoxide 201 (3, 4-epoxy-6-methylcyclohexylmethyl-3, 4-epoxy-6-methylcyclohexanecarboxylate), was a diepoxide, but may have hydrolyzed to form the monoepoxide during the reaction. Therefore, our data indicate that none of the monoepoxides imparted dry crease resistance, and that resorcinol diglycidyl ether and diepoxy stearic acid were the only diepoxides tested which did not impart some measure of dry crease resistance to the cloth under $Zn(BF_4)_2$ conditions of catalysis used in this investigation.

SURVEY OF OTHER ACID CATALYSTS——Many of the monoepoxides listed in Table II have high boiling points, but did not react with cotton even at 150° with fluoborate catalysts. Styrene oxide with or without various solvents in the presence of acid catalysts such as citric, formic, and glacial acetic acids, p-phenol sulfonate, and the cationic catalysts stannic chloride and cadmium fluoborate, did not add to cotton cellulose at 25°C. Phenyl glycidyl ether did not react with cellulose at 25°C or at 95°C in either glacial acetic acid or in chlorobenzene in the presence of stannic chloride as a catalyst. Several catalysts such as glacial acetic acid, 1% sulfuric acid, stannic chloride, and even boron trifluoride etherate failed to cause the 1,2 epoxy decane to react with cotton.

The effects of the introduction of acid groups, such as the acyl, phosphoryl, sulfo, or acetyl groups into cotton cellulose on the reactivities of the resultant modified cottons with various epoxy compounds were investigated. The only reactive modified cottons were two cellulose acetates, namely the lower cellulose polymer of commerce, secondary acetate, and a partially acetylated yarn investigated in this Laboratory. These were reactive only with the very reactive butadiene diepoxide. The triacetate or materials with low add-ons were inert under the experimental conditions of this investigation. The experimental range covered temperatures from 25° to 50°C and reaction times as long as 24 hours in the presence and absence of solvents.

The effects of emulsion polymerizations in the presence of acid catalysts were also investigated. Typical results of these endeavors are given in Table V. While initial weight gains were observed in some cases, most of the add-ons could be washed off with water or extracted from the cotton with various solvents. It appeared that polymerization of the epoxides and not reaction with cellulose predominated in these types of reactions.

ACTION OF BORON TRIFLUORIDE ON CELLULOSE——Since no mention of the action of boron trifluoride on cellulose could be found in the literature, a few experiments were conducted using boron trifluoride gas at room temperature. It was found that ordinary cotton yarn of 6% moisture content was instantly charred by the gas. Well-dried cotton, however, behaves differently. When a one-gram skein was dried with nitrogen from a sulfuric acid-barium oxide train, the moisture loss was 5.5% in four to six hours. Admission of boron trifluoride to such a dried yarn resulted in a 7-9% weight gain in 0.5 hour with only a pinkish and finally a brown coloration. The yarn fumed in air, and when washed to neutrality, 9% of its weight on a dry basis was lost or solubilized. However, 53% of the original breaking strength was retained as determined on a Suter Tester.[3]

When zinc fluoborate solution equal to the concentration used in the experiments reported in Table III was used on 80 × 80 print cloth and heated for five minutes a 125°C, only 20-27% of the original breaking strength was retained as determined on an Instron Tensile Tester.[3]

The experiments might be interpreted to show that boron trifluoride has a deleterious effect on the cellulose, as indeed it did; but apparently in the presence of an epoxide the effect is subdued in the case of the cloth and not worsened in the case of the yarn. In any event the loss in breaking strength varied from 40-60% when zinc fluoborate catalyst was used with various epoxides. Further proof of the relative harmlessness of zinc fluoborate catalyst is shown by its action with currently used dimethylol urea resins. In these instances the losses in breaking strength and tear strength of the cloth are no greater than with currently used catalysts.

When the cloth is padded with an aqueous or methanol solution of epoxide and zinc fluoborate catalyst and cured in an oven, the solvent and volatile epoxides are lost as boron trifluoride is generated. The boron trifluoride at the instant of its formation is probably complexed with the oxirane oxygen of the epoxide (*16, 25*) rather than with a carbon as is a hydroxyl group in base catalysis.

It has been suggested (*12*) that alkali cellulose and certain reactive epoxides combine by an S_N^2 mechanism at certain hydroxyl groups in the anhydro-glucose unit (*22*) through the mechanism of an alkoxide ion. In acid catalysis, the electrophilic group such as boron trifluoride molecule attacks the oxygen atom of the epoxide ring rather than a carbon atom (*11,16*) and results in the formation of an active intermediate which can either open the epoxide ring, or react with a nucleophilic center such as a cellulose hydroxyl, a water oxygen, or another epoxide molecule. Probably all of these reactions to a certain extent occur simultaneously.

Only an amazingly small amount of add-on, for example 1.7% in the case of butadiene diepoxide catalyzed with zinc fluoborate is required to produce marked changes in physical properties of the fabric, such as high crease angles, lowered Elmendorf tear and lowered break strength (*13*). From the results of this investigation it appears that little or no cellulose ethers are formed in many instances, but rather epoxide polymers. In many reactions where solutions of epoxides are used only low molecular weight polymers which are usually soluble in solvents are formed (*25, 26*).

SUMMARY OF CONCLUSIONS

The reactions of cellulose with various epoxy compounds in the presence of acid catalysts including hydrogen ion as well as cationic or Lewis acid catalyst have been studied.

Those epoxides which were found previously (*12*) to be most reactive with cotton cellulose under conditions of basic catalysis were presently found to be practically inert with hydrogen ion catalysis. For example, such reactive epoxides as ethylene oxide and butadiene diepoxide, which gave large add-ons to cotton under conditions of base catalysis, gave only slight addition in presence of hydrogen ion at room temperature in 20-24 hours. Aqueous zinc fluoborate solutions gave similar results and in this case the catalyst is probably acting by virtue of its hydrolysis to hydrogen ion in water. In any event the results are apparently equal to the values obtained with neutral salt solution.

When the latent Lewis acid catalysts, as exemplified by zinc fluoborate, is used at temperatures high enough to cause activation, 125°C or higher, it has been shown (*18*) that cotton becomes permanently crease resistant in the presence of certain commercially available epoxides. However, a number of discrepancies and anomalies have to be dealt with before any general theory for acid catalysis can be drawn up.

While it is true that *certain* diepoxides do indeed make cotton dry crease resistant, not *all* diepoxides (exceptions — resorcinol diglycidyl ether, diepoxy stearic acid) have this property. This discrepancy is probably caused by the upset of the electrophilic balance of the epoxides due to large substituted groups. Secondly, the diepoxides do not all add to the same extent (even when molecular weights are considered.) Yet in one case at least (butadiene diepoxide) better results are obtained at low add-on than at a higher intermediate value as measured by the crease angles obtained. Vinylcyclohexene diepoxide would appear to be another case in point though the values obtained with it are not as striking as butadiene diepoxide.

Furthermore, it is very difficult to explain the inertness of most of the monoepoxides toward cellulose with zinc fluoborate catalysis. It will be recalled that only two monoepoxides, and these possibly by reason of their special structure, added to the cotton. It would appear unreasonable to assess the reactivity of diepoxides to an activated boron trifluoride-epoxy intermediate if such an intermediate did not exist with a monoepoxide. Yet approximately twenty common monoepoxides fail to add to cellulose—let alone give crease resistance—by this method of catalysis. What is more, a number of these same twenty compounds do add by basic catalysis processes.

A still further anomaly is the fact that certain epoxides such as 1,2-epoxy decane do not add to cotton under any method of catalysis yet attempted by the writers. Yet this molecule is not as great or as complex as some which do add under one condition or another.

In regard to boron trifluoride as a catalytic agent it can be demonstrated that, in the absence of an epoxide, its effect on cotton can be ruinous but this is putting the compound in its worst light. In presence of epoxides or other types of crease resistance compounds the weakening of the cloth is no greater than currently used "safe" catalysts. This would force one to the conclusion that the formation of a cellulose ether and/or deposition of polymer in the fabric is the true cause of strength losses.

Finally, when the results of optimum base catalysis of diepoxides and cationic catalysis were compared it was found that, under the basic condition imposed, no dry resistance was imparted to the cotton—only the wet variety. Hence, it can be seen that no general theory of catalysis exists at present for addition of an epoxide to cotton because either type is assumed to serve primarily as a ring opener and it would be reasonable to expect that the product obtained—a partially etherified cotton—would have reasonably identical properties.

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Proceedings of the

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October 31, 1960 No. 22

1960 Intersectional Contest———
Second Prize Winner———

CONCURRENT DYEING AND FINISHING OF OF CELLULOSIC FABRICS*

DELAWARE VALLEY SECTION

A unique, practical single-step process has been developed for the simultaneous application of reactive dyes and alkaline-catalyzed urea-formaldehyde resins to cotton and viscose rayon. This results in fast brilliant dyeings having the desirable qualities of a "wash-wear" finish.

The process not only eliminates one complete processing operation, with resulting lower labor costs, but also results in a substantial increase in the color yield of the reactive dyes over conventional application methods for such dyes. The lightfastness of the reactive dyes is unaffected.

This process is applicable to any of the commercially available reactive dyes of the following chemical classes: vinyl sulfone, trichloropyrimidine, monochlorotriazine and dichlorotriazine.

The use of alkaline catalysts for the resins causes the reactive dyes to react primarily with the cellulose. This results in good resistance of the dyes to acid and alkaline perspiration.

The degree of resin fixation is such that readings of 260 to 270 degrees are obtained on cotton by the Monsanto Crease Recovery Test. This crease recovery is durable to multiple home launderings without chlorine at 140°F.

The process has been found to be practical on a commercial scale. Plant trials have been run successfully on cotton and viscose rayon using commercial finishing equipment.

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INTRODUCTION

IT has long been the goal of dyers and finishers to have a simple means of combining the coloration and creaseproofing of cellulosic fabrics using conventional dyeing or finishing equipment. This paper describes a unique, practical, single-step process for the simultaneous dyeing and finishing of cotton and viscose rayon through the use of reactive dyes, urea-formaldehyde resins and alkaline catalysts.

The new process imparts to both cotton and rayon, fast, brilliant shades, with all the desirable qualities of a "wash-wear" finish. The method is versatile since any of the commercially available reactive dyes can be used, as typified by the following chemical classes: vinyl sulfone, trichloropyrimidine, monochlorotriazine and dichlorotriazine.

This simultaneous dyeing and finishing process possesses the following advantages:

1) Dyeing and finishing are accomplished in a simple pad-dry-cure procedure as contrasted with the normal two-step process now in use, thereby cutting processing time and labor costs considerably.
2) A marked increase in color yield can be obtained over reactive dyes applied by conventional means.
3) There is no adverse effect upon the lightfastness of the dyes.
4) Resin fixation is such that readings of 260 to 270 degrees are obtained on cotton in the Monsanto Crease Recovery Test. Durability of the finish to multiple home launderings at 140°F without chlorine is excellent.
5) Resistance to acid and alkaline perspiration is good because the dye is reacted primarily with the cellulose.

After extensive interlaboratory testing, the practical commercial aspects of the process were proved on both cotton and viscose rayon using commercial finishing equipment.

OBJECT OF INVESTIGATION

It was the object of this investigation to find a simple means for the coloration and stabilization of cellulosic fabrics.

An extensive search of pertinent literature revealed that little inform-

*Presented by George C Kantner during the 1960 Intersectional Contest held October 7 at the Sheraton Hotel, Philadelphia, Pa.

ation has been published on the simultaneous application of dyes and resins to produce stabilized cellulosic fabrics in a complete range of shades having the desirable characteristics of crease resistance and ease of laundering.

The only one-step method of applying dyes and resins presently available is the use of resin-bonded pigments. This process does not impart to 100% cotton or 100% rayon fabrics the "wash-wear" characteristics which are so desirable. Many modern synthetic fibers inherently possess these desirable qualities. This is evident from their broad usage in the "wash-wear" or "minimum-care" market.

It was initially considered that a two-step process would be necessary to achieve the desired results since resins are normally catalyzed on the acid side and reactive dyes are "fixed" under alkaline conditions.

A preliminary process was developed whereby dyes and resins were applied simultaneously with an acid catalyst, dried, cured, then afterwashed in a strongly alkaline bath to fix the dye. While the process achieved some degree of success, over-all fastness properties and nonuniform dyeings precluded further work. Basically, the system was not a simple pad-dry-cure process. It is obvious that an increased potential would exist for cellulosic fibers if they could be colored in a full range of shades and stabilized in a simultaneous operation.

SURVEY OF DYES AND RESINS APPLICABLE TO CELLULOSE

Simplicity of application became the keynote of the project. Present systems involve the use of two separate steps in the production of resin-treated dyed cotton fabrics on a continuous basis.

1) Application of dye by padding or other means with subsequent scouring and drying.
2) Pad application of the resin, drying, curing, and afterwashing.

The effects of the application of resins on the fastness of dyes has been studied thoroughly and disclosed in numerous publications (*1*). Whether these fastness properties would be altered in simultaneous applications of dyes and resins became the starting point of the survey. The following broad spectrum of dyes was selected for study:

1) direct dyes
2) vat dyes
3) acid dyes
4) cationic dyes
5) reactive dyes.

Of these classes only acid and cationic dyes are not normally used in dyeing cellulosic fibers. Selected acid and cationic dyes are, however, used quite widely in printing of cotton.

The following types of thermosetting resins were selected for inclusion in the study:

1) dimethyl ethylene urea
2) acetal
3) triazone
4) melamine
5) urea-formaldehyde.

Systematic testing of each resin type was carried out with a selected group of dyes from each class according to the following table. A variety of acid salts were utilized as catalysts for resin. The results are summarized in Table I. The reactive dyes alone, as a class, were compatible with *all* the resins in the survey, produced dyeings of *good* initial color value and generally good wetfastness, and demonstrated variations in lightfastness which depended on the individual resins used.

TABLE 1
Simultaneous application of dyes and resins using acid catalysts

Reactive	Good initial olor Good wetfastness Lightfastness varies with resin
Acid	Fair-to-good initial color Poor wetfastness
Direct	Poor initial color, compatibility and wetfastness
Vats	Poor initial color, compatibility and wetfastness
Cationic	Poor initial color, compatibility and lightfastness

Thus, results of the first broad look at the project clearly indicated that concentration should be placed on the reactive dyes. The acid, direct, vat and cationic dyes were eliminated for one or more of the following reasons:

1) lack of compatibility
2) poor color yield
3) poor fastness properties

REACTION OF REACTIVE DYES UNDER ACIDIC CONDITIONS

In preliminary work with reactive dyes and resins, using acid salts as catalysts, a marked increase in color value was observed over control dyeings applied according to the manufacturers' recommendations.[1] It was suspected that the dye was reacting with the resin, since it is known that reactive dyes react with cellulose only under alkaline conditions (*2-7*).

The suspicion that acid catalysis resulted in dyeing only the resin was quickly confirmed by a mild hydrochloric acid stripping treatment which completely removed all the dye and resin from the fabric, leaving the fabric white. Alkaline-catalyzed reactive dyes applied alone are not removed by this stripping test.

Further confirmation of this came when excessive staining of effect fibers was noted when the acid-catalyzed "dyed" fabric was subjected to AATCC Acid Perspiration Standard Test Method 15-1957.

At this point in the evaluation of acid-catalyzed systems, the Committee was notified that the procedure was the subject of Belgian Patent No. 573,126 issued to Imperial Chemical Industries, Ltd. Further work on this phase of the project was discontinued so that there would be no interference or infringement on any patented process. The total effort was then directed to the alkaline-catalyzed resins which had been under investigation concurrently with the study of acid catalysis. It had been theorized that several desirable benefits would be realized if reactive dyes and resins could be applied to cellulosic fibers with alkaline catalysts.

1) The dye would have a better chance to react with the cellulose in the usual manner and would not be removed under acidic or resin stripping conditions.
2) Improved washfastness and acid perspiration fastness should result.

The problem thus resolved into one of finding a suitable thermosetting resin that would cure under alkaline conditions and give good crease recovery results.

ALKALINE CATALYSIS OF FIBER-REACTIVE DYES AND RESINS ON COTTON

It has been known for some time that ketone-formaldehyde and monomeric urea-formaldehyde resins are capable of being polymerized with alkaline catalysts (*8*). In addition to these resins the following types were also evaluated with alkaline catalysts:

1) acetal
2) melamine
3) triazones
4) epoxy.

While some of these resins gave good initial color yields, the urea-formaldehyde and ketone-aldehyde

[1] Application of monochlorotriazine and dichlorotriazine dyes to cellulose is the subject of USP 2,892,670 and USP 2,829,671 issued to Imperial Chemical Industries, Ltd.

October 31,

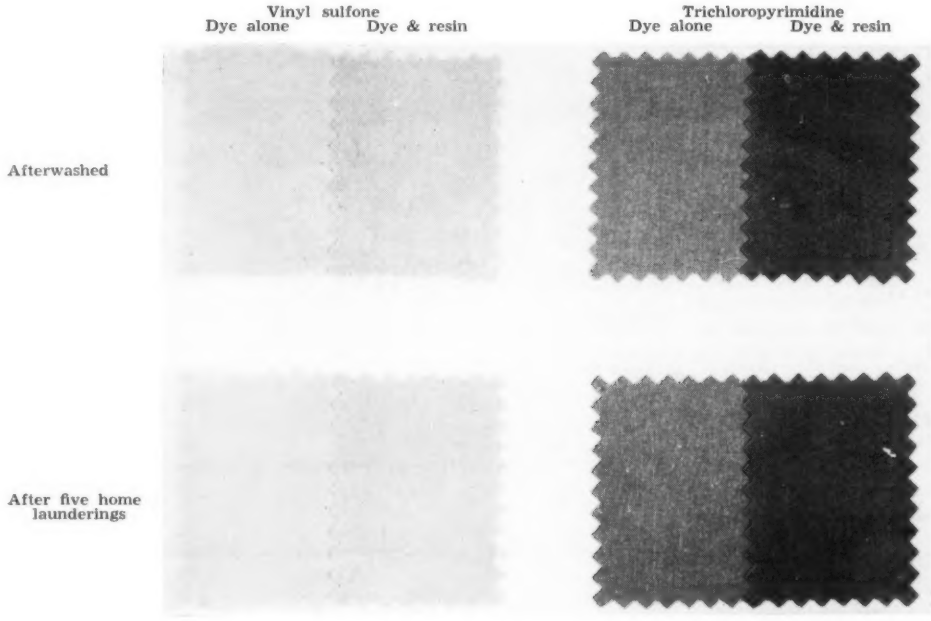

Figure 1
Alkaline catalysis
1% Fiber-reactive dye and 10% UF resin

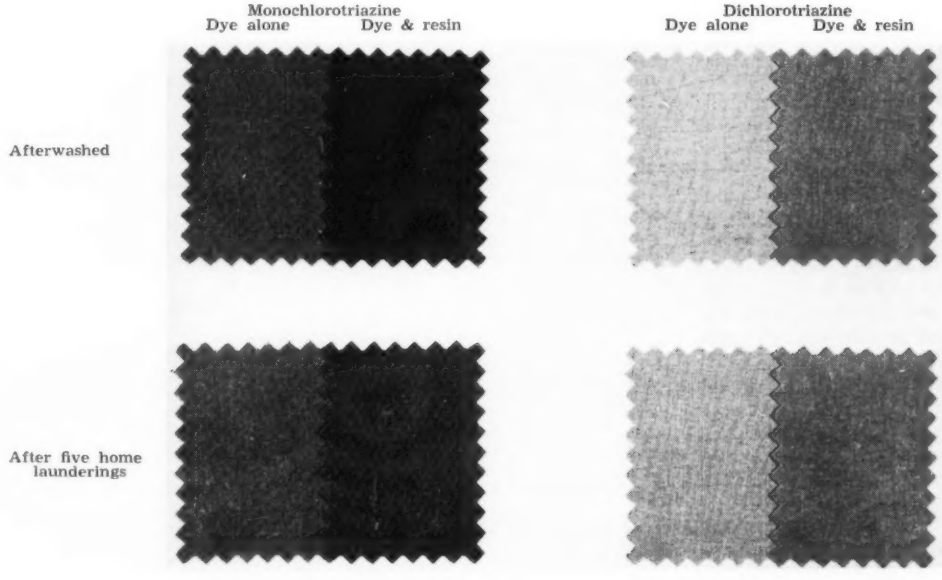

Figure 2
Alkaline catalysis
1% Fiber-reactive dye and 10% UF resin

resins were best for washfastness, lightfastness and crease recovery. The wider availability and use of urea-formaldehyde resins also made them the logical choice for further evaluation.

In May, 1959, various experiments were carried out on cotton which proved conclusively that when vinyl sulfone, dichlorotriazine or monochlorotriazine reactive dyes were mixed with 10% of monomeric urea-formaldehyde resin solids in the presence of 2% sodium carbonate or 3% sodium bicarbonate and padded on 80×80 cotton print cloth, dried and cured at conventional temperatures, the reactive dye fixed primarily to the cellulose. Resin fixation was insufficient to produce excellent results in the Monsanto Crease Recovery Test. The resin, furthermore, had no adverse effect upon the lightfastness of the dyes. The dyed fabric also exhibited surprisingly good resistance to acid and alkaline perspiration. Subsequent tests have shown that the newest commercial class of reactive dyes, the trichloropyrimidine dyes, could also be successfully applied by this process.

The finish produced by this process was tested extensively for fastness and "wash-wear" characteristics with striking results.

Figure 1 illustrates typical dyeings with vinyl sulfone and trichloropyrimidine dyes applied by pad-Thermofix treatment alone and also in conjunction with urea-formaldehyde resin. All dyeings were made with alkaline catalysts. The striking increase in color yield of the simultaneously dyed and finished sample is obvious. In the lower row of each set are samples of the same fabrics that have been subjected to five home launderings at 140°F without chlorine with only slight color loss.

Figure 2 shows typical dyeings with the monochloro- and dichlorotriazines applied by pad-Thermofix alone and also in conjunction with urea-formaldehyde resin using alkaline catalysts. The striking increase in color yield and durability to home laundering is readily apparent.

Tables II, III and IV illustrate the extensive physical testing to which the fabrics, simultaneously dyed and finished in the laboratory, were subjected. It can be seen readily that these treated fabrics had the following in common:

1) Increased color yield of from 20 to 50% over conventional dyeings.
2) Lightfastness relatively unaf-

TABLE
Fastness of vinyl sulfone reactive d

1.0% Vinyl sulfone dyeings	*Resin solids*	*Effect of resin on reactive* *Strength*	*Shade*	*Fade-Ometer* *SC*	*Fade-Ometer* *B*
Yellow GGL	—	control	control	4W,4D	5
Yellow GGL	10% UF	30% strong	4R	4W,5-4R	10
Yellow RT	—	control	control	3R,3W	5
Yellow RT	10% UF	50% strong	4R	5-4R,4W	10
Red B	—	control	control	3W,4D	5
Red B	10% UF	40% strong	4B1	4W	10
Red Violet R	—	control	control	4W	5
Red Violet R	10% UF	30% strong	4B1	3W	10
Brilliant Blue R	—	control	control	4W	5
Brilliant Blue R	10% UF	20% strong	5-4R,4D	3W,4D	10
Turquoise	—	control	control	4W	5
Turquoise	10% UF	40% strong	5-4,Br	4W,3G,	10
**Black B	—	control	control	3W	5
**Black B	10% UF	30% strong	3R	4W	10
Untreated control	—	—	—	—	—

*Hours to show slight break.
**4.0% dyeing instead of 1.0%

TABLE III
Fastness of monochlorotriazine dyes

1.0% Dyeings	*Resin solids*	*Fade-Ometer* *SC*	*Hrs**	*Monsanto crease recovery Control without resin* *W & F*	*Monsanto crease recovery Original* *W & F*
Monochlorotriazine Yellow	—	4R, D	80	163	—
Monochlorotriazine Yellow	10% UF	4R, D	80	—	260
Monochlorotriazine Red	—	3Bl, 4D, W	20	168	—
Monochlorotriazine Red	10% UF	3Bl, 4W	20	—	260
Monochlorotriazine Blue (Greenish)	—	4G, W	40	170	—
Monochlorotriazine Blue (Greenish)	10% UF	4R, W	80	—	255
Monochlorotriazine Blue (Reddish)	—	5-4R, 4W	40	165	—
Monochlorotriazine Blue (Reddish)	10% UF	5-4R, 3W, D	40	—	262
Untreated Control	—	—	—	158	—

*Hours to show slight break.

TABLE IV
Fastnes: of dichlorotriazine dyes co-

1.0% Dyeings	*Resin solids*	*Effect of resin on reactive* *Strength*	*Shade*	*Fade-Ometer* *SC*
Dichlorotriazine Yellow	—	control	control	4R,W,D
Dichlorotriazine Yellow	10% UF	20% stronger	trace green	4W
Dichlorotriazine Red	—	control	control	3W
Dichlorotriazine Red	10% UF	20% stronger	noticeably blue, trace dull	3W,3D
Dichlorotriazine Blue (Greenish)	—	control	control	4W
Dichlorotriazine Blue (Greenish)	10% UF	20% stronger	noticeably red and trace dull	3R,D
Dichlorotriazine Blue (Reddish)	—	control	control	3W
Dichlorotriazine Blue (Reddish)	10% UF	20% stronger	sli red	4W,4R, 3D
Untreated Control	—	—	—	—

*Hours to show slight break.

coapplied with urea-formaldehyde resin

After five home laundering cycles SC	Monsanto crease recovery — Control W & F	Monsanto crease recovery — Resin W & F	Monsanto crease recovery — After five home launderings W & F	Scott tensile one-inch cut strip — Control W & F	Scott tensile one-inch cut strip — Treated W & F	Elmendorf tear W & F (grams)	
5	143	—	153	—	—	780	380
4W	—	258	253	—	—	590	320
5	147	—	157	73	—	—	—
4W	—	253	256	—	61	—	—
5	148	—	148	77	—	760	430
4W	—	260	253	—	59	670	240
5	140	—	146	74	—	—	—
5-4W	—	245	249	—	63	—	—
5	136	—	158	80	—	780	450
4W	—	253	257	—	62	600	250
5	145	—	167	—	—	—	—
5-4W	—	248	262	—	—	—	—
4W	152	—	166	—	—	—	—
4W,4R	—	259	260	—	—	—	—
—	158	—	—	78	—	—	—

3) Slight loss of color after five home launderings at 140°F without chlorine.
4) Excellent initial Monsanto crease angles and only slight losses after five home launderings.
5) Tensile strength and tear strength losses well within acceptable limits for resin-treated 80×80 cotton sheeting. (No softener was used to improve tear strength. A polyethylene softener was incorporated in subsequent plant trials.)

ALKALINE CATALYSIS OF REACTIVE DYES AND UF RESIN ON VISCOSE RAYON

A series of application tests was also conducted on viscose rayon challis during the summer of 1959 using reactive dyes with UF resins and alkaline catalysts. Color yields were greatly enhanced and durability to home laundering was excellent. Tables V and VI outline some of the physical properties tested.

Table V illustrates the excellent crease recovery results obtained when 18% of urea-formaldehyde resin and reactive dye are applied concurrently using an alkaline catalyst.

In Table VI, tensile strength and tear strength tests are shown on the concurrently dyed and finished viscose rayon challis compared with untreated fabric. These results are typical of those obtained on conventionally resin-treated viscose rayon challis.

PLANT TRIALS

Since laboratory work had been so successful it was decided to prove the commercial value of such a process by running it on regular finishing equipment. Two trials were run, one on viscose rayon and one on cotton.

PLANT TRIAL ON VISCOSE RAYON———The first trial was run on viscose rayon in the pilot plant of the American Viscose Corporation

ABLE III
azine dyes
applied with urea-formaldehyde resin

Monsanto crease recovery Five home launderings W & F	Scott tensile one-inch cut strip Control without resin W & F	Scott tensile one-inch cut strip Treated W & F	After five home laundering cycles SC	Effect of resin on reactive — Shade	Effect of resin on reactive — Strength
—	68	—	5-4W	control	control
257	—	49	4R, W	30% stronger control	noticeably red control
—	86	—	4Bl		
248	—	39	4B, W	10% stronger control	trace yellow & bright control
—	78	—	5-4W		
250	—	55	4W	50% stronger control	consid red, sli dull control
—	68	—	4R, W		
248	—	55	4R, 3W	30% stronger	noticeably green sli br
—	78	—	—	—	—

ABLE IV
e dyes co-
pplied with urea formaldehyde resin

Fade-Ometer hrs*	After five home laundering cycles SC	Monsanto crease recovery — Control W & F	Monsanto crease recovery — Resin W & F	Monsanto crease recovery — After five home launderings W & F	Scott tensile one-inch cut strip — Control without resin W & F	Scott tensile one-inch cut strip — Treated W & F
40	5-4W	166	—	165	65	—
80	4W	—	259	255	—	57
40	4W	164	—	138	72	—
20	4W	—	251	247	—	52
40	4W	163	—	166	71	—
20	4-3W	—	263	256	—	58
40	4W	159	—	153	75	—
40	4W	—	258	256	—	49
—	—	158	—	—	79	—

TABLE V
Alkaline catalysis
1% Reactive dye and 18% UF resin

	Monsanto crease recovery (°) — Initial W & F	Monsanto crease recovery (°) — After five home launderings W & F
Untreated rayon challis	188	190
Dyed and finished	274	271

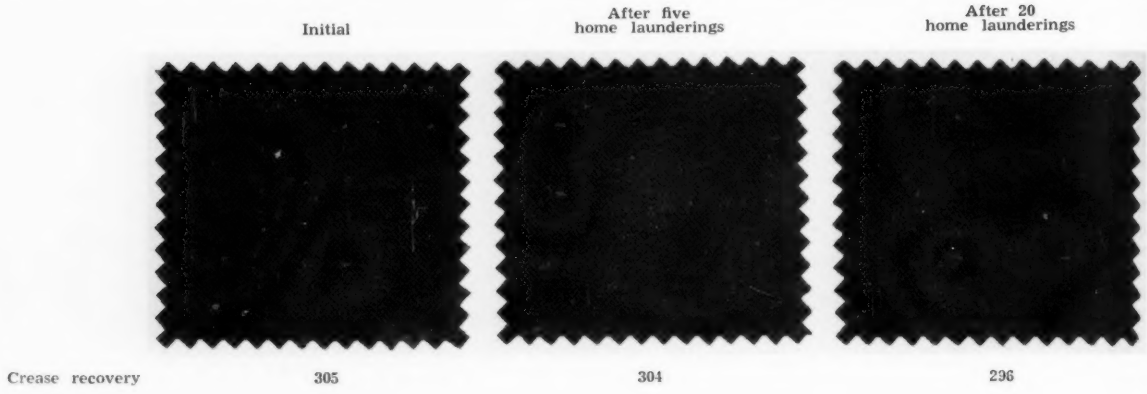

Figure 3
Plant trial on viscose rayon
Alkaline catalysis of 2% vinyl sulfone blue and 18% UF resin
Crease recovery and durability to home laundering

TABLE VI
Alkaline catatlysis
1% Fiber-reactive dye and 18% UF resin

	Grab tensile (pounds)		*Elmendorf tear (grams)*	
	Warp	*Filling*	*Warp*	*Filling*
Untreated rayon challis	55	48	1220	930
Dyed and finished	60	46	1650	1180

TABLE VII
Simultaneous application of dye and resin to viscose rayon

Step		
1) Pad	UF resin (solids)	18% owf
	Vinyl sulfone dye	2% owf
	Polyethylene softener	2% owf
	Sodium bicarbonate	4% owf
2) Dry		
3) Cure	335°F, three minutes	
4) Wash	140°F	
5) Rinse		

TABLE VIII
Mill trial on rayon challis
Physical test data

Test	*Control*	*Simultaneously dyed and finished*	*20 Washings 140°F Agitator-type home washer*
Texture	74 × 65	73 × 62	72 × 62
Grab Strength (lb)			
*Cond—warp	56.4	61.6	57.2
fill	48.0	44.9	42.1
**Wet —warp	30.6	40.8	38.7
fill	22.8	31.4	32.0
Elmendorf tear (lb)			
Cond—warp	2.69	3.71	3.79
fill	2.04	2.68	2.64
			Washings
		10	*20*
Crease recovery—warp	95°	154	155° 151°
fill	93	151	149 145°
Stoll-flex (two-pound tension & one-half pound headweight)	126.2	37.8	72.4
Wash & Wear (AATCC Method 88-1958)			
Drip dry		1.3	1.0
Tumble dry		4.0	4.8
Washfastness	*1st Wash*	*5th Wash*	*20th Wash*
140°F Shade change	4	3	3
Staining	5	4	—
	Shade change	*Staining*	
Drycleaning	4	5	
Perspiration—alkaline	4	5	
acid	4	4	

*Fabrics conditioned at 58 ± 2% relative humidity and 75 ± 2°F.
**Fabrics were wet out in water and measured while still wet.

at Marcus Hook, Pa, on April 1, 1960. A 64 × 62 challis construction viscose rayon fabric was simultaneously dyed and finished by the formulation and procedure listed in Table VII.

The fabric was padded double dip, single nip and then dried on a pin tenter at 180°F. The fabric was cured on the pin tenter at 335°F for three minutes. Afterwashing was done on a jig.

The fabric was dried on a pin tenter, using a 10% overfeed, at 240°F and then framed to finished dimensions of 45 inches on a steam clip frame.

Figure 3 shows the good initial crease recovery obtained on viscose rayon in this mill trial and the excellent durability to five home launderings. After 20 home launderings the crease recovery angle must be considered outstanding since it only dropped nine degrees.

The surprising durability of the color is amply illustrated by these samples showing only a slight color loss after five home launderings at 140°F without chlorine, and no significant further loss when the same sample was subjected to a total of 20 home launderings.

Table VIII illustrates the physical tests run on the mill-treated viscose rayon challis. Tear and tensile strength results are comparable to those obtained on conventionally resin-treated rayon challis. Of particular importance is the surprisingly good resistance to acid and alkaline perspiration.

PLANT TRIAL ON COTTON——The second plant trial of the process was conducted at a large commercial finishing plant on 80 × 80 bleached, mercerized cotton print cloth on April 12, 1960.

A total of nine hundred yards of fabric was processed. A run consisting of 300 yards of fabric was made on each of the three formulations in Table IX to apply the indicated percentages to the fabric.

PADDING——300 yards of fabric were padded through each formula-

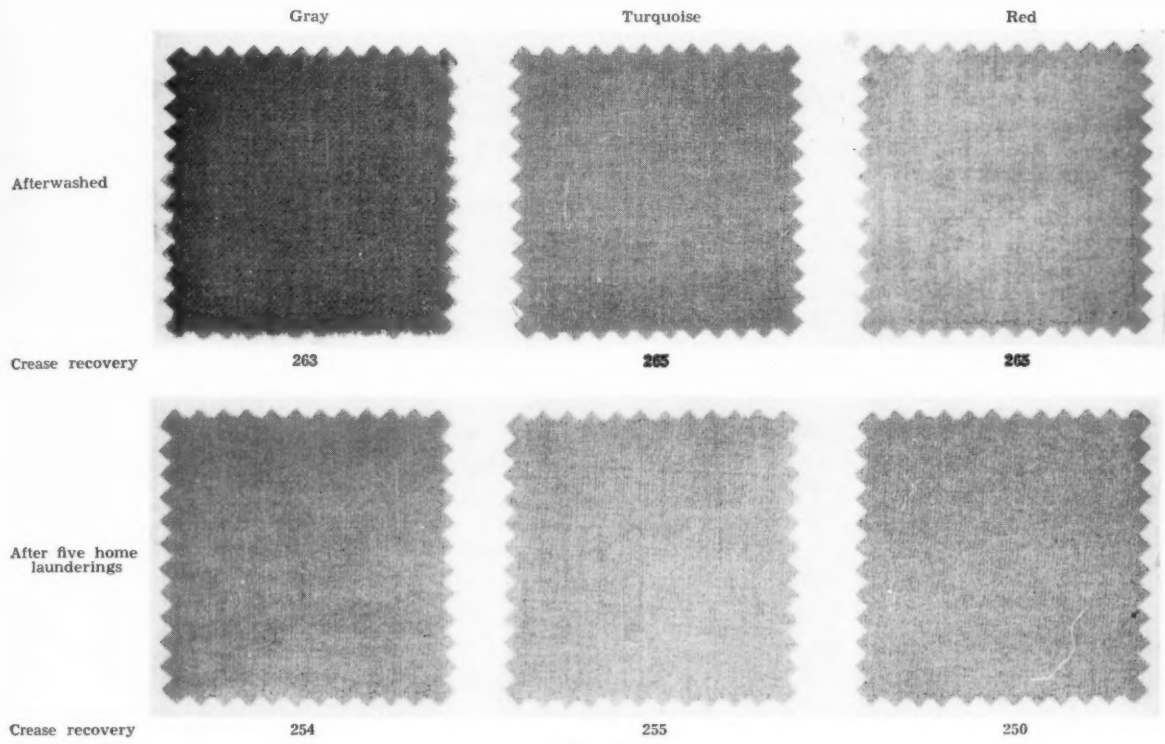

Figure 4
Plant trial on 80 X 80 cotton
Alkaline catalysis of fiber-reactive dyes and 10% UF resin

tion at 90 yards per minute using a pad having 12 tons pressure and utilizing a single dip and a single nip. Wet pickup was 70%.

DRYING——The fabric was dried on a clip frame at approximately 220°F, the fabric coming off dry.

CURING——All three dyeings were stitched together and cured for three minutes at 340°F.

AFTERWASHING——The fabric was then scoured while still sewn together on a seven-bowl continuous washing range. The scouring bowls were maintained at 140°F. There was no apparent bleeding and no cross staining during the scouring operation. This was felt to be very noteworthy in view of the type of scouring normally required with reactive dyes plus the fact that three distinct shades were unaffected when scoured in the same scouring liquor in rapid sepuence. The fabrics were then frame dried to finished dimensions.

Figure 4 shows the excellent initial crease recovery obtained on all three cotton fabrics processed on commercial finishing equipment. It further illustrates the negligible loss in crease recovery and color noted when the fabrics were subjected to five home launderings at 140°F without chlorine.

Table X lists the physical tests conducted on the mill-treated 80 × 80 cotton sheeting. It illustrates the effect of the alkaline-catalyzed dyeing and finishing system on the tear and tensile strength of the fabric. Tensile strength losses vary from 28 to 30% and average losses in tear strength vary from 4% in the warp to 17% in the filling. These results can be considered very acceptable for resin-treated 80 × 80 cotton sheeting.

In addition it also shows the Monsanto "wash-wear" ratings obtained after five home launderings. Results are equal regardless of whether

TABLE IX
Plant trial on 80 x 80 mercerized cotton sheeting

Color	Reactive Dye	
Gray	0.5%	Vinyl sulfone red
	0.5%	" " yellow
	0.5%	" " red violet
Turquoise	1.0%	Trichloropyrimidine turquoise
Red	1.0%	Vinyl sulfone red
UF resin (solids)	10%	
Polyethylene softener	2%	
Catalyst ($NaHCO_3$)	3%	
Nonionic surfactant	0.05%	

TABLE X
Tests on mill-treated 80 x 80 cotton

	*Initial crease recovery**	*Crease recovery after five** home washes*	*(Grab) tensile strength pounds* W	F	Total	*(Elmendorf) tear strength grams* W	F	*Monsanto "wash-wear" rating after five home launderings* Drip dry	Tumble dry
Gray	263	254	46	29	75	858	394	4	4
Turquoise	265	248	47	26	73	874	413	4	4
Red	265	254	39	24	63	870	416	4	4-5
Untreated	160	—	64	41	105	902	496	—	—

*Fabric tested was taken from both selvage edges—avg of four determinations.
**Hot Point agitator-type automatic; hot water 140°F; Tide detergent; full cycle, run consecutively; pressed after last wash.

the samples are drip dried or tumble dried.

CONCLUSIONS

The brilliant, fast shades which are made possible through the use of cellulose-reactive dyes have been further enhanced by this work. It has been found feasible to produce crease-resistant finishes and bright, fast dyeings on cotton and rayon using a simple, practical, one-step pad-dry-cure procedure by applying cellulose-reactive dyes and urea-formaldehyde resin simultaneously. The use of an alkaline-catalyzed system permits rapid and efficient fixation of both the dye and resin. Thorough investigation has disclosed that the dye is attached primarily to the cellulose.

Monsanto crease-recovery measurements, together with other physical test data, have proved that the resin is also thoroughly polymerized and fixed in the fiber.

The practical aspects of this new process have been evaluated on commercial finishing equipment. The end results are acknowledged to be a unique, practical, simpler method of dyeing cellulose with reactive dyes and finishing the fabric at the same time.

A colored motion picture made during the commercial trials of the process was presented at the October 1960 AATCC Convention.

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ACKNOWLEDGMENTS

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American Viscose Corp
Carbic-Hoechst Corp
E I duPont de Nemours & Co, Inc
Geigy Chemical Corp
Hart Products Corp
Hercules Powder Co
James Lees and Sons, Inc
Millville Manufacturing Co
Philadelphia Textile Institute
Quaker Chemical Co
Rohm and Haas Co

Elected to Membership

No designation after name indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
* indicates transfer from another class of membership.

October 5, 1960

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Jerome E Levy (A)

Delaware Valley Section

Albert Bagian
William F Lehr

SOUTHERN REGION

South Central Section

Ruth S Mooney

WESTERN REGION

Mid-West Section

Milton M Waldman
William G Schoon (A)

NOT AFFILIATED WITH A SECTION

Brodsky Braodsky (J)

October 19, 1960

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Pacific Southwest Section

Norman W Garrett Jr

STUDENT CHAPTER

Georgia Institute of Technology

Malcolm D Caldwell (S)
Charles D Stewart (S)

NOT AFFILIATED WITH A SECTION

Kamil Rassoulian
Otto Sternbach

Delaware Valley

DELAWARE VALLEY SECTION met on Friday, September 16, at the Reading Country Club, Reading, Pa, with 165 members and guests in attendance for dinner and 35 for the golf activity which was held in the afternoon.

O C Holland, director of advertising for Interchemical Corp's Printing Ink Division, served as guest speaker. For more than 12 years, Mr Holland has made color come alive before various groups throughout this country and Canada. His lectures are noted for their informal and entertaining way of presenting a highly technical subject. He peppers them with feats of slight-of-hand and "color-magic" to clearly explain color and show how it fools the eye. Since color is purely a visual phenomenon for most of us, Mr Holland uses eye-popping demonstrations with brilliant colors, powerful lights and sparkling exhibits. Even magnetism is used to entertain and instruct. His talks are lively and fast-moving with many practical examples of how to use color.

Donald W Robinson, Para-Chem, Inc, chairman of the Nominating Committee, presented the following slate of candidates for office in 1961: *Chairman* — Clarence A Seibert; *vice chairman*—Edward G Haack; *treasurer*—Charles N Kuzma Jr; *secretary*—Ernst W Empting; *sectional committeemen* — Walter W Gleadall, Francis A Mather, Joseph J Murphy, Fred V Traut; *Councilors* —William H Bertolet III, James E Conway, L Kevin McChesney, Virgil D Lyon; *chairman emeritus*—Percival Theel.

Western New England

WESTERN NEW ENGLAND SECTION met on Friday, September 23 at the Crossroads Restaurant, Springfield, Mass, with approximately 50 in attendance.

A minute of silence was called for in memory of Joseph Melody of Danbury, Conn, who recently passed away rather suddenly.

A film covering fiber-reactive colors was shown through the courtesy of Ciba Co, Inc. Speaker of the evening was Fritz Raff of Ciba, who delivered a general talk on printing and the various dyestuffs that might be used in the several printing processes. Mr Raff discussed dyestuff types, various thickening media, and reducing agents.

1960 Intersectional Contest

Third Prize Winner———

A STUDY OF FLUOROCARBON FINISHES AND THEIR EFFECT ON DYESTUFFS*

RHODE ISLAND SECTION

COMMITTEE

Edward N Alexander,
chairman and speaker

William E Aldrich
Kenneth J Broden
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Raymond B Taylorson

INTRODUCTION

THE recent development of fluorocarbons for the textile finishing industry has caused considerable interest because of their unique property of imparting oil repellency. Prior to the development of these materials, oil repellency on a fabric could only be achieved through coatings or laminating processes, which were usually costly and time-consuming. Now, by using fluorocarbon emulsions, oil-repellent finishes can be readily applied through the use of conventional padding equipment; also the oil repellency is obtained without loss of air permeability, an effect which is not possible when coating techniques are employed.

To date, there have been few papers published (*6, 7, 8, 9, 12*) in relation to textile finishing uses of fluorocarbons. What information has appeared in the literature deals mostly with fluorocarbons as applied alone to undyed fabrics, and reports of studies on oil repellency and physical properties of the treated material. Because of this limited information regarding practical applications, it was felt that further investigations of fluorocarbons in relation to their effect upon other finishing materials and upon dyestuffs would provide information of value to the textile industry.

The purpose of this project was to study the compatibility of fluorocarbons with various finishing agents; their effect upon the physical properties of the treated fabrics; their effect upon shade and colorfastness of dyestuffs; and the effect of dyestuffs upon oil repellency of the fluorocarbon finishes.

Compatibility tests were made, using fluorocarbons in combination with resins, water repellents and softeners. Paddings were then made with selected fluorocarbons finishes on both dyed and undyed fabrics, which in turn were used for the above-mentioned areas of investigations.

*Presented by Edward N Alexander during the 1960 Intersectional Contest held October 7 at the Sheraton Hotel, Philadelphia, Pa.

HISTORY AND CHEMISTRY OF THE FLUOROCARBONS

Fluorocarbons, as the name implies, are compounds containing fluorine and carbon. Structurally they are analogous to the hydrocarbons, but their chemical properties differ radically from their hydrocarbon analogues. While the hydrocarbons are reactive materials, being readily oxidized or attacked by other chemicals, the fluorocarbons are unreactive materials which are not easily oxidized or attacked.

In contrast with the stability of the fluorocarbons, fluorine is one of the most reactive elements and is seldom found in the free state. In its combined state it is more abundant than many metals, such as zinc or copper, and comprises 0.078% of the earth's crust. It is found principally in the mineral fluorospar which was known and used as a metallurgical flux in the fifteenth century. Fluorine was first isolated in 1886, when the French chemist Henri Moissan electrolyzed anhydrous hydrogen fluoride. This basic method of preparing fluorine is still in general use today.

Although chemists were greatly interested in the reactivity of fluorine, it was not until 1926 that the first fluorocarbon tetrafluoromethane CF_4 was prepared by Lebeau and Damiens (*1*). During the 1920s certain chlorine-fluorine-carbon compounds (Freons, Genetrons) were found to have suitable properties for refrigerants. Only two fluorocarbons, tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6), had been isolated until 1937 when Simons and Block (*2, 3*) disclosed the preparation of several other liquid fluorocarbons by the reaction between fluorine and carbon using a mercury catalyst. Because of the requirements for materials with chemical inertness and good thermal stability a crash program on the preparation of fluorocarbons was instituted during World War II. This resulted in the metallic fluoride process developed by a research group at Johns Hopkins University and a catalytic process developed by a research group at Columbia University.

Fluorocarbons have found wide use during the last ten years as propellants, wetting agents, textile-treating agents, pharmaceutical intermediates, lubricants, elastomers, adhesives, sealants, plastics, films, protective coatings, and fire-extinguishing agents. Commercial products available are the chlorofluoro and bromofluoro methanes and ethanes sold under the tradenames of Freons (E I duPont de Nemours & Co, Inc) Genetrons (General Chemical Div, Allied Chemical Corp), Ucons (Union Carbide Corp), and Isotrons (Pennsalt Chemicals Corp). Fluorinated alcohols and fluorine-containing olefins such as chlorotrifluoroethylene are available from Pennsalt Chemicals Corp. Minnesota Mining & Manufacturing Co markets perfluorocarboxylic acids.

In 1953, Reid (*4*) indicated that perfluoro fatty acid complexes could be used to produce surfaces which are hydrophobic and oleophobic. Ahlbrecht et al (*5*) in 1953 suggested also that hydrophobic and oleophobic properties could be also obtained with acrylic ester polymers. Philips, Segal and Loeb (*6, 7*) reported that oil- and water-repellent finishes were obtained with the following:

a) Chromium complexes of saturated perfluoromonocarboxylic acids. $(CF_3(CF_2)_nCO_2Cr_2OH)^{4+}$

b) Polymers of fluoroalkyl esters of acrylic acid.

$$(-CH_2CH_2-)_n$$
$$|$$
$$COOCH_2R_f$$

where R_f is any perfluorinated alkyl group.

Quarpel (*8*), a combination of fluorocarbon and pyridinium-type water-repellent finish, is reported to give enhanced durability to washing of the water-repellent properties.

A recent article by Benerito, Berni and Fagley (*9*) discloses a chemical reaction of perfluorobutyryl and perfluorooctanoyl chloride with cellulose to obtain durable oil and water repellency.

EXPERIMENTAL PROCEDURE

The fluorocarbon compound used throughout this work was a 28-30% nonionic emulsion of a fluorocarbon acrylic latex.

The various finishing agents were commercial products of which the general classification is known.

The fabric used in all cases, except with the thermoplastic resins, was 80×80 4.00 mercerized, bleached percale. The fabric used for the thermoplastic resins was 80 × 80 4.00 unmercerized, bleached percale.

In conducting our investigation the following experimental procedures were employed.

PAD BATH COMPATIBILITY ——Various thermosetting resins, thermoplastic resins and methylol stearamide water-repellents were tested for pad-bath compatibility with fluorocarbons. Solutions were made containing 45-55 g/l fluorocarbon with normal concentrations of the type of finishing agent to be tested. With thermosetting resins and methylol stearamide water-repellents, an amine hydrochloride catalyst was used. With one methylol stearamide water-repellent, an ammonium sulfate catalyst was recommended by the manufacturer and therefore was used. The solutions were vigorously agitated and visual observations made. Scum or precipitate formation was considered as an indication of incompatibility. When this condition was noted with the thermosetting resins or the methylol stearamide water-repellents, the test was repeated, using 0.1% of a nonionic surface-active agent.

Softeners were tested for pad-bath compatibility by preparing solutions containing 50 g/l fluorocarbon and 3.5-11.0 g/l (solids) of the softeners. The solutions were mixed with a minimum of agitation and observation was made. Any formation of scum, precipitate or separation indicated incompatibility. If no such evidence was noted after standing four hours, the solution was considered stable.

These procedures pointed out which finishing agents were compatible with fluorocarbons but were not intended to determine stability in a continuous padding operation.

CONTINUOUS PADDING STABILITY——The method used for testing the pyridinium water-repellents simulated actual plant conditions. This test was made by preparing a solution containing 50 g/l fluorocarbon, 80 g/l pyridinium water-repellent, and 10 g/l sodium acetate, which was placed in a laboratory padder box. A continuous piece of 80×80 percale was run through the padding solution and into the nip, which was set for approximately 70% pick-up, for one-half hour. The condition of the padding solution was observed periodically, and also the padder rolls were checked for any fluorocarbon latex build-up.

PADDING PROCEDURE——The padding operation consisted of immersing the fabric in the padding solution, then squeezing in a laboratory padder with the pressure so regulated that the resulting pick-up was 70-80%. The treated fabric was then dried at 220°F and cured at 330°F for one and one-half to two minutes.

DYEING PROCEDURE——Dyeings of medium depths were made on 80×80 4.00 bleached, mercerized cotton. The direct, copper aftertreated direct, developed, vat and naphthol dyes were applied by conventional laboratory methods. The reactive dyes were applied either by pad-thermofixation or by pad-steam methods. The pigment dyeings were produced in light shades using the Sherdye padding system. The pigment prints were made with the Aquaprint Supra System. Both the pigment dyeings and pigment prints were fully cured before the application of the various finishes.

The following representative dyes from various dye classes applicable to cotton were used for this work.

I) Direct and Copper Aftertreated Direct Dyes
1) CI Direct Yellow 28
2) CI Direct Red 81
3) CI Direct Blue 71
4) CI Direct Yellow 39
5) CI Direct Red 83
6) CI Direct Blue 90
7) CI Direct Yellow 39 (aftertreated with a copper-dye-fixing agent)
8) CI Direct Red 83 (aftertreated with a copper-dye-fixing agent)
9) CI Direct Blue 90 (aftertreated with a copper-dye-fixing agent)

II) Developed Dyes
10) CI Direct Red 122
11) CI Direct Red 127
12) CI Direct Blue 126
13) CI Direct Green 47

III) Vat Dyes
14) CI Vat Yellow 2
15) CI Vat Brown 1
16) CI Vat Blue 6
17) CI Vat Green 1

IV) Naphthol Dyes
18) CI Azoic Coupling Component 20
Fast Red Violet LB Salt
19) CI Azoic Coupling Component 12
CI Azoic Diazo Component 42
20) Naphthol AS-FGGR
CI Azoic Diazo Component 3

V) Reactive Dyes
21) Procion Yellow RS
22) Procion Brilliant Red 2BS
23) Procion Brilliant Blue RS
24) Cibacron Brilliant Yellow 3G
25) Cibacron Brown 3GR
26) Cibacron Brilliant Red 3B
27) Cibacron Turquoise Blue G
28) Remazol Brilliant Orange 2R
29) Remazol Red Violet R
30) Remazol Brilliant Blue R

VI) Pigment Dyeings
31) Benzidine Yellow (RB 90)
32) Fast Red ITR/Naphthol AS-ITR (RB 60)
33) Chlorinated Phthalocyanine Blue (RB 21)
34) Phthalocyanine Green (RB 40)

VII) Pigment Prints
35) Benzidine Yellow (RB 90)
36) Fast Red ITR/Naphthol AS-ITR (RB 60)
37) Chlorinated Phthalocyanine Blue (RB 21)
38) Phthalocyanine Green (RB 40)

The above dyeings were finished using the following selected finishing formulas:

A) Fluorocarbon
- 45 g/l fluorocarbon
- 8.75 g/l sodium acetate (anhydrous)

B) Fluorocarbon with Resin
- 45 g/l fluorocarbon
- 80 g/l alkylated UF resin (50% solids)
- 10 g/l amine hydrochloride catalyst (35% solids)

C) Fluorocarbon with Water Repellent
- 45 g/l fluorocarbon
- 80 g/l pyridinium water repellent
- 9.6 g/l sodium acetate (anhydrous)

D) Fluorocarbon with Resin and Water Repellent
- 45 g/l fluorocarbon
- 80 g/l alkylated UF resin (50% solids)
- 80 g/l pyridinium water repellent
- 9.6 g/l sodium acetate (anhydrous)

For additional control purposes, a number of dyeings were also finished as follows:

E) Resin
- 80 g/l alkylated UF resin (50% solids)
- 10 g/l amine hydrochloride catalyst (35% solids)

F) Water Repellent
- 80 g/l pyridinium water repellent
- 9.6 g/l sodium acetate (anhydrous)

TEST METHODS

OIL REPELLENCY———This test is a modification of the oil-repellency test devised by the Minnesota Mining & Manufacturing Co, and is based on the relative penetrating power of mineral oil and mineral oil/n-heptane mixtures. Mixtures with a higher n-heptane content have a lower surface tension and therefore a greater penetrating power.

Mixtures of USP mineral oil and n-heptane were prepared; an oil-repellency rating was assigned, and surface-tension determinations were made.

To measure the oil repellency of a treated fabric, a drop of each mixture was placed on the surface of the fabric and allowed to stand for three minutes. The drops were then removed by "wicking" with either tissue paper or a blotter. The oil-repellency rating was determined by observing the stains, if any, left by the drops. For example, if the fabric were stained by the mixture containing 60% mineral oil, but not stained by the mixture containing 70% mineral oil, an oil-repellency rating of 80 would be assigned to the fabric.

Oil repellency rating	*USP mineral oil* (% by vol)*	*N-heptane (% by vol)*	*Surface tension dynes/cm (Du Nouy)*
100+	40	60	20.40
100	50	50	21.40
90	60	40	22.25
80	70	30	23.75
70	80	20	25.25
50	100	0	28.75
0	Stains with mineral oil		

*Saybolt viscosity reading at 100°F—176/183 seconds.

WATER REPELLENCY———AATCC Standard Test Method 22-1952.

RESISTANCE TO LAUNDERING———Automatic home washer with Tide.

COLORFASTNESS TESTS———
Wash Test: AATCC Standard Test Method 36-1957
Lightfastness: AATCC Standard Test Method 16A-1957
Crockfastness: AATCC Standard Test Method 8-1957
Shade Change: Visual comparison with the International Geometric Gray Scale

DISCUSSION AND CONCLUSIONS

FLUOROCARBON AND THERMOSETTING RESINS———The oil- and water-repellency results on fabric finished with fluorocarbon in combination with various commercial thermosetting resins (see Table I) were, with one exception, acceptable, with ratings from 90 to 100+. The durability of the finish was in all cases excellent.

The combination of fluorocarbon and melamine-type resin when used with 1.0 g/l surfactant gave an initial spray rating of 80 which, however, improved to 90 after five washings. Apparently a nondurable rewetting factor was present which was removed in the laundering.

The addition of surfactant in making up the pad bath prevented or reduced scum formation in formulas where it had been present. Whether or not a scum was present in the finishing bath appeared to have little effect on the oil or water repellency of the finished fabric. However, the presence of scum in the padding solution could conceivably cause running difficulty on a plant scale by the build-up on pad rolls and other equipment of large quantities of the finishing materials. The triazine-type resin was the only resin which showed no indication of any scum formation.

TABLE I
Fluorocarbon and thermosetting resins

Type Resin	*Concentration Resin g/l*	*Concentration Fluorocarbon g/l*	*Concentration Amine HCl, 35% g/l*	*Concentration Surfactant g/l*	*Oil repellency Original*	*Oil repellency Five launderings*	*Water repellency Original*	*Water repellency Five launderings*	*Pad bath compatibility*
Control	—	50	—	—	100	80	100	90	no scum
Control	—	50	—	1	100	90	90	90	no scum
Modified UF #1	80	50	10	—	100	100	100	100	slight scum
Modified UF #1	80	50	10	1	100	90	100	90	very slight scum
Modified UF #2	80	50	10	—	100	100	100	100	heavy scum
Modified UF #2	80	50	10	1	100	100	100	100	very slight scum
DMEU	80	50	10	—	100	90	100	90	medium scum
DMEU	80	50	10	1	100	100	100	100	no scum
Triazine	80	50	10	—	90	90	100	90	no scum
Triazine	80	50	10	1	90	90	100	90	no scum
Triazone	80	50	10	—	100	100	100	90	heavy scum
Triazone	80	50	10	1	100+	100	100	90	no scum
Melamine	40	50	10	—	100	90	90	90	heavy scum
Melamine	40	50	10	1	100	90	80	90	heavy scum
Modified melamine	60	50	10	—	100	90	90	100	very slight scum
Modified melamine	60	50	10	1	100	90	100	90	no scum

Cured for 1.5 minutes at 330°F.

TABLE II
Fluorocarbon and thermoplastic resins

Type Resin	Concentration Resin g/l	Concentration Fluorocarbon g/l	Oil repellency Original	Oil repellency Five launderings	Water repellency Original	Water repellency Five launderings	Pad bath compatibility
Control	—	55	100	50	80	50	compatible
Nonionic							
acrylic #1	100	55	100	50	50	0	compatible
acrylic #2	100	55	100	0	50	0	compatible
Anionic							
butadiene styrene	100	55	100	50	50	50	compatible
butadiene acrylonitrile #1	100	55	100	0	50	0	compatible
butadiene acrylonitrile #2	100	55	90	0	0	0	compatible
butadiene acrylonitrile #3	100	55	100	0	50	0	compatible

Cured for 1.5 minutes at 330°F.

TABLE III
Fluorocarbon and softeners

Type Softener		Concentration Softener g/l	Concentration Softener solids g/l	Concentration Fluorocarbon g/l	Oil repellency Original	Oil repellency Five launderings	Water repellency Original	Water repellency Five launderings	Pad bath compatibiltiy	Pad bath stability (after four hours)
None—Control		—	—	50	100+	100	80	80	compatible	stable
CATIONIC										
Fatty amine condensate	I	11	3.5	50	100+	100+	80	70	compatible	stable
" " "	I	33	10.5	50	70	70	—	—	compatible	stable
" " "	II	14	3.5	50	80	0	50	0	compatible	stable
" " "	II	28	7.0	50	70	0	50	0	compatible	stable
" " "	III	14	3.5	50	100	50	50	50	compatible	stable
" " "	III	28	7.0	50	80	50	50	0	compatible	stable
Fatty quaternary salt	I	8	6.0	50	100+	80	80	50	compatible	sl scum
" " "	I	14	10.5	50	100+	70	70	50	compatible	sl scum
" " "	II	20	5.0	50	100+	70	80	50	compatible	stable
NONIONIC										
Modified fatty ester deriv	I	20	6.0	50	100+	90	90	80	compatible	stable
" " " "	I	35	10.5	50	100+	80	80	70	compatible	stable
" " " "	II	10	3.5	50	100	100	0	0	compatible	stable
" " " "	II	30	10.5	50	0	0	—	—	compatible	stable
" " " "	III	14	3.5	50	70	50	0	0	compatible	stable
" " " "	III	28	7.0	50	50	0	0	0	compatible	stable
Polyethylene emulsion	I	20	5.2	50	100+	—	—	—	compatible	stable
" "	I	35	9.0	50	100	50	70	70	compatible	stable
" "	II	11	3.5	50	0	0	0	0	particles	particles
" "	II	33	10.5	50	0	0	—	—	particles	particles
" "	III	14	3.5	50	100	80	80	80	compatible	stable
" "	III	28	7.0	50	100	90	80	70	compatible	stable
ANIONIC										
Modified fatty ester deriv	I	14	3.5	50	50	0	0	0	particles	particles
" " " "	I	28	7.0	50	50	50	0	0	particles	particles
" " " "	II	10	3.5	50	—	—	—	—	incompatible	—

Cured for 1.5 minutes at 330°F.

FLUOROCARBON AND THERMOPLASTIC RESINS———It can be readily seen from Table II that the addition of thermoplastic resins to fluorocarbon does not appreciably affect the oil repellency, but does reduce the water repellency. The oil- and water-repellency ratings for this table are lower than usual after laundering. This loss could be due to the fact that the paddings were made on unmercerized, bleached percale, whereas all other paddings were made on mercerized, bleached percale. Unfortunately, this effect was observed near the end of our work and time was not available to pursue our investigation of this phenomenon any further.

FLUOROCARBON AND SOFTENERS———The effect of a range of representative cationic, anionic, and nonionic softeners on fluorocarbon finishes was investigated, and the results are listed in Table III. With the exception of the anionic softeners tested, the softeners were reasonably compatible with the fluorocarbon emulsion, and pad baths were stable for at least four hours.

Use of the softeners provided a beneficial effect on the softness and drape of the fabric compared to the fluorocarbon alone. As illustrated in Table III, the softeners varied widely in their effect on the oil- and water-repellency of the treated fabric and in the durability of these properties to laundering. In most cases, the softener had an adverse effect on these properties, and generally an increase in concentration of the softener resulted in a decrease in oil- and water-repellency and the durability of these properties to laundering.

Although no generalization regarding the suitability of softeners can be made on the basis of chemical classification, a few of those products tested, notably a cationic amine condensate, a nonionic modified fatty ester derivative, and a nonionic polyethylene emulsion, produced no appreciable effect on the repellency or durability of the fluorocarbon finish when used in moderate amounts. The addition of 1.0 g/l nonionic surface-active agent, 0.5 g/l sodium acetate, and 50 g/l isopropanol to the fluorocarbon-softener formulations had little or no effect on oil- and water-repellency in a number of direct comparisons against fluorocarbon and softener alone.

FLUOROCARBON AND WATER REPELLENTS (EXCEPT PYRIDINIUM———The stearamide-type and thermosetting resin compound-type water repellents (see Table IV) were catalyzed in accordance with manufacturer's recommendations and applied at three different use levels in conjunction with a reduced concentration of 25 g/l fluorocarbon. This is an approximation of the amount of fluorocarbon commercially applied on cotton when these combinations are used.

The oil- and water-repellency results indicate wide variations between the effectiveness of the different

TABLE IV

Fluorocarbon and water repellents (except pyridinium)

Type Water Repellent	Concentration Water repellent g/l	Concentration Fluorocarbon g/l	Concentration Amine HCl (35%) g/l	Concentration Ammonium sulfate g/l	Concentration Surfactant g/l	Oil repellency Original	Oil repellency Five launderings	Water repellency Original	Water repellency Five launderings	Pad bath compatibility
Control	—	25	—	—	1	90	80	100	80	good
I) Methylol stearamide dispersed with melamine resin	30	25	0	10	1	90	80	100	90	good
	60	25	0	10	1	100	80	100	90	
	90	25	0	10	1	100	70	100	90	
II) Methylol stearamide dispersed with melamine resin	30	25	10	—	1	80	0	100	80	slight scum
	60	25	10	—	1	70	0	100	80	
	90	25	10	—	1	70	0	90	70	
III) Methylol stearamide dispersed with UF resin	30	25	10	—	1	0	0	90	70	slight scum
	60	25	10	—	1	0	0	90	0	
	90	25	10	—	1	0	0	80	0	
IV) Thermosetting resin compound	10	25	10	—	1	70	50	80	80	good
	20	25	10	—	1	80	50	90	90	
	30	25	10	—	1	90	80	90	90	
V) Silicone emulsion (with 18 g/l silicone catalyst)	50	25	—	—	1	0	0	90	80	good

Cured for 1.5 minutes at 330°F.

TABLE V

Fluorocarbon and pyridinium water repellents

Type Water Repellent	Concentration Pyridinium WR g/l	Concentration Fluorocarbon g/l	Concentration Sodium acetate (anhyd) g/l	Oil repellency Original	Oil repellency Five launderings	Water repellency Original	Water repellency Five launderings	Continuous padding stability
Control	—	25	—	90	80	100	80	stable
Control	—	50	—	100	80	100	90	"
Control	—	75	—	100	80	100	90	"
Pyridinium #1	30	25	3.6	70	0	100	80	stable
do	60	25	7.2	70	50	100	90	"
do	90	25	10.8	90	90	100	100	"
do	30	50	3.6	80	70	100	80	"
do	60	50	7.2	100	90	100	100	"
do	90	50	10.8	100+	100	100	100	"
do	30	75	3.6	100	80	100	80	"
do	60	75	7.2	100+	90	100	100	"
do	90	75	10.8	100+	100+	100	100	"
Pyridinium #2	30	25	3.6	0	0	80	80	stable
do	60	25	7.2	50	70	100	90	"
do	90	25	10.8	50	50	100	100	"
do	30	50	3.6	0	0	100	90	"
do	60	50	7.2	70	80	90	100	"
do	90	50	10.8	90	90	100	100	"
do	30	75	3.6	90	90	90	80	"
do	60	75	7.2	100	90	100	100	"
do	90	75	10.8	100+	100	100	100	"
Pyridinium #3	30	25	3.6	50	0	90	90	stable
do	60	25	7.2	100+	80	100	90	"
do	90	25	10.8	100+	100	100	90	"
do	30	50	3.6	90	90	100	80	"
do	60	50	7.2	100+	100+	100	90	"
do	90	50	10.8	100+	100+	100	100	"
do	30	75	3.6	100	90	100	90	"
do	60	75	7.2	100+	100+	100	100	"
do	90	75	10.8	100+	100	100	100	"

Cured for two minutes at 330°F.

stearamide types in combination with fluorocarbon. It is particularly noticeable in the oil repellency where Water Repellent I gives excellent results and Water Repellent III gives zero oil repellency ratings. Water Repellent II gives fair initial oil repellency but poor durability to washing.

The thermosetting resin compound, a 100% active product, was used at one-third the concentration of the stearamide products which are generally considered to be 25-50% active. This product produced good results, particularly at the higher concentration.

It is noteworthy that Water Repellents I and IV, producing the best results, had no scum formation in the bath, whereas the products having poor results did have scum in the bath, even though a nonionic surface-active agent was present. Although the compatibility of the silicone emulsion with fluorocarbon is good, the silicone apparently has a deleterious effect on the oil repellency and no abnormal effect on the water repellency.

FLUOROCARBON AND PYRIDINIUM WATER REPELLENT———The continuous padding stability of the three pyridinium water repellents used in combination with fluorocarbon (see Table V) was satisfactory in all cases, even though each product had slightly different characteristics with respect to appearance, solubility, and pad bath viscosity. At higher concentrations of water repellent and fluorocarbon there was a definite synergistic effect which was evident by the increase of the oil-and water-repellency initially and after five launderings. Although the magnitude of the oil- and water-repellency varied with each water repellent, the increased repellency was proportionate to the increased concentrations. Pyridiniums #1 and #3 attained their maximum performances at 90 g/l water repellent and 50 g/l fluorocarbon, whereas Pyridinium #2 did not attain its maximum performance until the concentrations were 90 g/l water repellent and 75 g/l fluorocarbon.

FLUOROCARBON AND VARIOUS FINISHING AGENT COMBINATIONS———In combination with fluorocarbon and modified UF resin the nonionic softener (see Table VI) gives adverse results on both oil- and water-repellency and this

TABLE VI

Fluorocarbon and various finishing agent combinations

Types of Finishing Agents	Concentration Fluorocarbon g/l	Concentration Thermosetting resin g/l	Concentration Thermoplastic resin g/l	Concentration Pyridinium WR g/l	Concentration Softener g/l	Concentration Amine HCl (35%) g/l	Concentration Sodium acetate (anhyd) g/l	Oil repellency Original	Oil repellency Five launderings	Water repellency Original	Water repellency Five launderings	Pad bath compatibility
Modified UF Resin and cationic softener #1	40	120	—	—	10	15	—	100+	90	90	70	good
	40	120	—	—	20	15	—	100	70	80	50	good
Modified UF resin and cationic softener #2	40	120	—	—	10	15	—	90	90	100	100	good
	40	120	—	—	20	15	—	100	90	100	70	good
Modified UF resin and nonionic fatty ester softener	40	120	—	—	10	15	—	100	70	80	50	good
	40	120	—	—	20	15	—	80	50	0	0	good
Modified UF resin and nonionic polyethylene softener	40	120	—	—	10	15	—	100	80	90	90	good
	40	120	—	—	20	15	—	100	90	100	90	good
Triazine resin and Pyridinium WR *	55	80	—	80	—	10	9.6	90	0	100	80	good
	55	80	—	—	—	10	9.6	80	0	70	70	good
Acrylic resin and Pyridinium WR *	55	—	50	80	—	—	9.6	100+	90	100	80	good
	55	—	100	80	—	—	9.6	100+	90	80	70	good

Cured for 1.5 minutes at 330°F.
* Cured for two minutes at 330°F.

effect increases at the higher softener concentration. Cationic softener #1 gives poor results in spray rating, but does not seem to affect oil repellency. Again increased concentration of softener gives poorer results. Cationic softener #2 gives good results at both concentrations.

The nonionic polyethylene softener ency as well as the initial oil- and water as the softener concentration increases. Pad-bath compatibility was good for each type of softener used even though no surface-active agent was used in the formula.

The addition of a thermoplastic resin to a pyridinium water repellent and fluorocarbon improved the durability of the oil- and water-repellency as well as the initial oil- and water-repellency. The thermosetting triazine resin by comparison did not give as good results when used in the same formula.

EFFECT OF FLUOROCARBON ON DYESTUFFS———The fluorocarbon by itself caused a weakening of the shade of CI Direct Red 81, a pronounced dulling and bluing of CI Direct Red 127 (coupled with Beta Naphthol), a pronounced dulling and bluing on Procion Brilliant Red 2BS, and dulling and yellowing on Cibacron Turquoise Blue G. However, the shade changes obtained with fluorocarbon combined with modified UF or pyridinium-type water repellent did not cause shade changes greater than those expected by conventional finishing methods.

The shade changes obtained on vat, naphthol, other fiber-reactive, and pigment dyes were comparatively insignificant.

INFLUENCE ON LIGHTFASTNESS———On direct, copper aftertreated direct, and developed dyes, the fluorocarbon finish by itself appeared to decrease the lightfastness to some extent. However the fluorocarbon in combination with either modified UF resin or pyridinium water repellent does not cause any greater change in lightfastness than the same finish applied without the fluorocarbon.

INFLUENCE ON WASHFASTNESS———Direct and copper aftertreated direct dyes are improved in their washfastness to a moderate extent when finished with fluorocarbon by itself. This improvement is, however, not as pronounced as when a resin finish is applied either by itself or in combination with a fluorocarbon.

Developed dyes show no improvement in washfastness when a fluorocarbon finish is applied by itself. When the fluorocarbon is applied in combination with modified UF resin or pyridinium water repellent or both, the improvement in washfastness is as good as when these finishes are applied without fluorocarbon.

On vat, naphthol, reactive and pigment dyes the fluorocarbon by itself or in combination with modified UF resin or pyridinium water repellent has no significant influence on the washfastness.

INFLUENCE ON CROCKFASTNESS———The fluorocarbon finish by itself or in combination with other finishing agents does not appear to have any influence on the crockfastness greater than that obtained by the conventional finishing agents alone.

On vat dyes and reactive dyes, the fluorocarbon finish by itself or in combination with other finishing agents does not show an impairment of the crockfastness over that obtained by conventional finishing agents. Exceptions, however, were CI Vat Brown 1 and CI Vat Green 1, which did show a slight impairment of crockfastness with fluorocarbon by itself but not with fluorocarbon/finishing agent combinations.

A fluorocarbon finish seems to have very little effect on the crockfastness of naphthol combinations.

On pigment-pad dyeings, the fluorocarbon finish has very little effect on crockfastness. On heavy pigment prints, a slight impairment in crockfastness was observed with the fluorocarbon finish, but conventional finishing agents can show even a greater influence.

INFLUENCE OF THE DYESTUFF ON WATER- AND OIL-REPELLENCY———From the numerous tests conducted it would appear that the dyestuff as such has no influence of any practical significance on water- or oil-repellency. However, it is recommended that surfactants and possibly electrolytes used in various dyebath applications be thoroughly removed by rinsing before the material is finished.

The binders used for pigment paddings as well as pigment prints could cause a lower pickup of finishing agents and subsequent lowering of the oil- and water-repellency.

SUMMARY

Results of this study indicate that fluorocarbons vary widely in their compatibility with other finishing materials. As a class, thermosetting resins and methylol stearamide water repellents show separation in the finishing bath but can be made compatible by the addition of a surface-active agent. Water-repellents generally are compatible. Thermoplastic resins and softeners vary even among similar chemical types.

Oil- and water-repellency were affected to varying degrees by the in-

(*concluded on page 42*)

Annual Banquet——

PRESIDENT'S ADDRESS*

WELDON G HELMUS

FELLOW members of AATCC—ladies and gentlemen:—

It is my privilege, as your president, to address you briefly at this time, and to report to you on the state of our Association's affairs.

Within the next few months, I will be turning over the gavel to our new president. I hope he will feel as I did when I first took office in January, 1959—that he has inherited a smooth-functioning organization, an efficient administration, and a challenge.

AATCC is making good progress—in its research and technical activities; in communicating information through its publications; in maintaining a sound fiscal position; and in its effort to improve its usefulness to the members and to the industry. I would like to highlight these four areas to demonstrate to you that your Association's officers and committees have been actively at work in the interest of strengthening and broadening AATCC services to each of you and your fellow members everywhere.

Our research committees are producing a continual flow of test methods and scientific data. Since the first of the year, new test methods have been developed for Colorfastness of Textiles to Commercial Laundering and Domestic Washing; for Dimensional Changes in Woven or Knitted Textiles (excluding wool); for the Determination of Noncotton Content of Bleached Cotton Textiles; for the Determination of Alkali in Bleach Baths Containing Hydrogen Peroxide; for the Relaxation or Felting Shrinkage of Woven or Knitted Wool Textiles. Our research committees are constantly revising our test methods to keep them current so that you may have the best tools available to work with.

During the year revisions have been made in the test methods for Evaluating Wash-and-Wear Fabrics after Home Laundering; in the Carbon Arc Test in Colorfastness to Light; and the test for Colorfastness to Drycleaning. The test method for the Determination of the Electrical Resistivity to Yarns has had such acceptance as to suggest that we raise it from a tentative to a standard test method. Work has been reactivated on tests for Colorfastness to Water, Resistance to Insect Pests and Evaluation of Creasing Properties of Fabrics.

I mention these titles by name in order to give you some idea of the wide cross-section of technology within our industry with which we are concerned.

We are working closely with many agencies both in industry and government. For example, we are pursuing common interests with the Technical Association of the Pulp and Paper Industry, the Society of Automotive Engineers and the Commodity Standards Division of the US Department of Commerce. The AATCC Committee on Stream Sanitation has received national recognition for its contributions to the industrial waste conferences and its cooperation with the U S Department of Health, Education and Welfare. Our association is in the process of becoming a member of the International Federation of Associations of Textile Chemists and Colorists. Through this affiliation, we shall be able to strengthen our position in the family of societies like our own, which are working toward a common goal the world over.

One important problem we have wrestled with is whether we should not assume more responsibility in the field of standards. I believe that the conscience of our members has again expressed itself in reaffirming our policy of concerning ourselves with the development of test methods and scientific data, and to avoid the involvements and commitments implied by standards, particularly those involving end-use performance. This is a commercial and not a scientific matter, better left to the commercial arms of our industry.

Our *Technical Manual* continues to uphold its reputation as one of the most important reference works in our industry. Substantial improvements have been made in the arrangement and the presentation of the text material. I might add that the next edition is expected to be in your hands in the near future.

The manuscript work on a new edition of our monograph on "Analytical Methods for a Textile Laboratory" is underway. Arrangements have been made for publishing bound volumes of our *Proceedings*, which will be available to our members and to libraries around the world. The *Colour Index* project is producing surplus funds which will be allocated to research projects as these funds become available. Adoption by the United States Bureau of Customs and the Tariff Commission of *Colour Index* reference data encourages us to believe that the steady demand for the *Colour Index* will continue. Material for a supplement volume will be completed in March of 1961 and publication will follow shortly. A series of supplements is now being planned to perpetuate the currency of the *Colour Index* as a permanent service.

Our financial policies are conservative and our position healthy. The Association has retained Standard and Poor's Corporation to advise on its investments and has opened a brokerage account with Bache and Company. We believe it prudent to seek the counsel of the best-informed professional sources to insure that our excellent portfolio of securities prospers.

A modest pension plan for our employees at National Headquarters has been inaugurated. I feel that this has been a step forward in bringing our employee policies into line with those of similar societies and associations.

The Executive Committee of the Council has been giving some thought to means for establishing graduate fellowships and underwriting research projects. This might be accomplished by placing a safe ceiling on our accumulated funds and utilizing surpluses for such programs as stated in the constitutional objects of our Association. We should not let these funds pile up in cash and securities beyond a reasonable level. They must be expended—and wisely—for benefits and services to our members, at the same time retaining reserves which will protect us over the years.

I had hoped to be able to report to you that our National Headquarters offices had been relocated in the wing of the modern, new building going up on the campus of the Lowell Technological Institute. Due to unforeseen circumstances, delays in construction have occurred which have

*Presented October 8, 1960 at the Annual Banquet during the 1960 AATCC Convention at the Hotel Sheraton, Philadelphia, Pa.

postponed our date of occupancy indefinitely.

Our membership has reached a new high—not a spectacular increase in members to be sure, but there is a definite upward trend in evidence. Our goal of 10,000 members is a realistic objective, and with the enthusiastic and active cooperation of our Membership Committee and the Sections, we should be able to keep this momentum going.

Two new Sections have just been formed in the Piedmont territory, one within the borders of South Carolina and the other in northern North Carolina and lower Virginia. This is a healthy sign of growth. It will give the members in this area more opportunity to participate and will concentrate the energy of the leadership in three centers instead of one. I predict that, within five years, the membership of these three Sections will double the present membership of the old Piedmont Section.

I would like to touch on a few of the things we should be thinking about as we enter this new decade of the 1960s. We are going to see a lot of changes in our industry—many more than in the last decade. The competition for new markets for textiles will become increasingly intense. The competition for men to enter our industry will become an even more serious problem. The technological competition with other industries will become more acute. We will literally be fighting for our economic lives. If we are to survive, we must face up to these challenges with bold programs of action. We cannot afford to be complacent or to depend on the day-to-day answers to solve long-term problems.

AATCC can do its part and its share. I think we have the capacity and the facilities to make important contributions. Our first obligation is to our members. Our second major responsibility is to the industry. I can envision a three-point program which will help our members stay in the industry and help the industry stay in business.

First, let us point our research program more directly to the consumer, providing a technical and scientific bridge between our industry and the consuming public.

Second, let us sharpen up our services to our members in an effort to elevate their professional and scientific status so that qualified men and women will continue to be attracted to the textile industry. We can do much to bring into focus an image of career opportunities in textiles.

And third, and this will need the full support of the industry itself, let us strengthen our research program on all fronts. Let me appeal to management in repeating a recent statement I made to the press and here I quote;

"AATCC's program is geared to a cooperative industry-wide effort which through its committee system brings together the highest technical competence available in the industry. The efforts of these people must be supported by funds and facilities to enable them to contribute their fullest talents.

"This can only be done in a climate provided by management and designed to encourage their maximum participation in AATCC. Let every company become AATCC-minded and support the AATCC research program to the fullest. It is an investment that will pay dividends — dividends through research."

In rendering an accounting of my stewardship during my term of office, I would like to emphasize that any accomplishments which have been achieved over the past two years have been the result of a cooperative effort stemming from the leadership of the national officers as a group.

Any credit for achievement must be directed to those with whom I have closely worked and who have collectively shared in the judgments and decisions in solving operating and policy problems. To them I owe a debt of gratitude for their help, their guidance and support. I should also like to express my appreciation to the staff of the National Headquarters for the excellent job it has done during my administration in assisting me in carrying out my duties and responsibilities.

In closing, I would like to congratulate Fred Traut and the many people who have worked with him in putting on this excellent Convention. The Technical program, the social events and the facilities for the comfort of our members visiting in Philadelphia are evidence of many long hours of thought and planning.

To each and every one who had a part in the 1960 Convention, I would like to say—thank you— in behalf of all of us who are here.

PIEDMONT SECTION WINS 21st INTERSECTIONAL CONTEST

Delaware Valley Second, Rhode Island Third

PIEDMONT Section's entry "Chemical Mechanisms in Chlorine Retention by Resin-treated Cotton Fabrics" was judged the winner of the 21st annual Intersectional Contest, held October 7 in the Ballroom of the Hotel Sheraton, Philadelphia, Pa, during the 1960 Convention.

Second place was awarded to the Delaware Valley Section for its entry, "Concurrent Dyeing and Finishing of Cellulosic Textiles", and the Rhode Island Section's paper "A Study of Fluorocarbon Finishes and Their Effect on Dyestuffs" was third.

Other entries were "A Study in Union Dyeing" by the Northern New England Section, and "Selection of Direct Dyestuffs for Application to Unsulfured Rayon Staple" by the Southeastern Section.

The win by the Piedmont Section was its sixth in the history of the Intersectional Contest and its fourth in the last five years. Only the Rhode Island Section has more first-place awards with seven.

Delaware Valley's second-place finish was its seventh, to give it a lead of one over the Northern New England Section for most runner-up awards. Delaware Valley also leads in third-place finishes with seven.

Rhode Island's third-place finish was its fifth.

Speakers for the competing sections were as follows: Piedmont—R L Wayland Jr, Dan River Mills; Delaware Valley—George C Kantner, Rohm & Haas Co; Rhode Island—Edward N Alexander, Crown Chemical Co; Southeastern—James H Cox, Auburn University; Northern New England—Bennett S Gesmer, Dyecraftsmen, Inc.

Membership Applications

September 22-28, 1960

NEW ENGLAND REGION
Rhode Island Section

Transfer to Senior

L Russell Maguire—Supt of dyeing, Cranston Print Works Co, Webster, Mass. Sponsors: G B Stackpole, J C Smith.

Western New England Section

Transfer to Senior

William N Wright Jr—Chemist, Wm E Wright & Sons Co, West Warren, Mass. Sponsors: D Francesketti, A H Rant.

CENTRAL ATLANTIC REGION
Metropolitan Section

Senior

Bertil H Bresky—Asst sales mgr, export, Interchemical Corp, Color & Chem Div, Hawthorne, NJ. Sponsors: W W Chase, S Meeker.

Gabriel Karoly—Chem mgr, Esso Research & Eng Co, Linden, NJ. Sponsors: C A Cohen, L T Eby.

Delaware Valley Section

Senior

Paul M DesCoteaux—Research chemist, American Viscose Corp, Marcus Hook, Pa. Sponsors: H H Hall, J W Schappel.

Charles Hammond—Sales rep, Ciba Co, Inc, Philadelphia, Pa. Sponsors: F E Nevins, A E Bride.

SOUTHERN REGION
Piedmont Section

Senior

Clayton C Gaddy—Supt cotton div, North Carolina Finishing Co, Salisbury, NC. Sponsors: V B Wright Jr, E E House.

William M Pittendreigh—Dir of res, Riegel Textile Corp, Ware Shoals, SC. Sponsors: G M Kidder, G R Thompson.

Paul E Robbins—Asst prof of textile chemistry, Textile Dept, Clemson College, Clemson, SC. Sponsors: J Lindsay, M Goldenberg.

Junior

C Philip Gamble—Latex control chem, Wica Chem, Inc, Charlotte, NC. Sponsors: W V Walukewicz, J C Boesch.

Southeastern Section

Senior

John G Frick Jr—Chemist, Cotton Chem Lab, Southern Utilization & Development Div, U S Department of Agriculture, New Orleans, La. Sponsors: R M Reinhardt, J D Reid.

Associate

Jack L Gogek—Supv, Applications research, Texas Butadiene & Chem Co, So Miami, Fla.

WESTERN REGION
Mid-West Section

Transfer to Senior

Edward P Bangs—Finishing engr, Kinkead Industries Inc, Chicago, Ill. Sponsors: W H Sites, B Fay.

Frederick D Brown—Textile chemist, Minnesota Mining & Mfg Corp, St Paul, Minn. Sponsors: J S Panto, F K Burr.

NOT AFFILIATED WITH A SECTION

Associate

William O Goulden—Vice president, Verona Dyestuffs Ltd, St Laurent, Montreal, Que, Canada.

STUDENT CHAPTERS
Auburn University

Student

Bufrey D Dean—Student, Auburn Univ, Auburn, Ala. Sponsor: James H Cox.

Leron R Dean—Student, Auburn Univ, Auburn, Ala. Sponsor: James H Cox.

Lowell Technological Institute

Student

Phyllis Ann Healy—Student, Lowell Technological Inst, Lowell, Mass.

•

September 29—October 5, 1960

SOUTHERN REGION
Piedmont Section

Junior

Robert M Marshall—Chemist, Wica Chemicals, Inc, Charlotte, NC. Sponsors: W V Walukewicz, J C Boesch.

Student

Lester F Stevens—Student, High Point College, High Point, NC. Sponsor: E O Cumming.

WESTERN REGION
Mid-West Section

Junior

Donald C Richardson—Dyer, Auburn Dyeing & Finishing Co, Auburn, Ky. Sponsors: J L McGowan, L Hoehn Jr.

NOT AFFILIATED WITH A SECTION

Junior

Abbas Y Sabir—Chemist in lab, Fedco Private Ltd, Mafatlal House, Bombay, India.

October 6-12, 1960

NEW ENGLAND REGION
Western New England Section

Senior

Harold G Hencken—Director of engg & research, American Felt Co, Glenville, Conn. Sponsors: T J Gillick Jr, E L Johnson.

Norman C Davis Jr—Standards & specifications, American Felt Co, Glenville, Conn. Sponsors: A Bibeau, E L Johnson.

Joseph A Kenny—Product dev engr, American Felt Co, Glenville, Conn. Sponsors: A Bibeau, E L Johnson.

CENTRAL ATLANTIC REGION
Metropolitan Section

Senior

Walter J Olenick—Asst plant mgr, Atlantic Chem Corp, Nutley, NJ. Sponsors: A Lubin, M Birnbaum.

Washington Section

Senior

Donald P Gush—Chemist, Harris Research Labs Inc, Washington, DC. Sponsors: A E Davis, F W Minor.

Piedmont Section

Senior

Chesley W Singleton—Plant chemist, Burlington Finishing Co, Old Dominion Finishing Plant, Altavista, Va. Sponsors: F B Cook Jr, J H Shelton.

WESTERN REGION
Mid-West Section

Senior

Norvald B Siverson—Dyer, Munsingwear Inc, Minneapolis, Minn. Sponsors: G B Willgeroth, J L McGowan.

Piedmont Section

Senior

Gene N Cline—Chemist, Wica Chemicals, Inc, Charlotte, NC. Sponsors: W V Walukewicz, J C Boesch.

STUDENT CHAPTERS
Bradford Durfee College of Technology

Student

John A Bond, Paul Braz, Michael H Frain, John T Hackett, Brian F Hayes, Paul M Leite, Thomas S McKenna, Herbert Mednick, August Reis, and *Lawrence F Welch*—Students, Bradford Durfee College of Technology, Fall River, Mass. Sponsor: C E Medde.

Lowell Technological Institute

Student

Ram B Patel—Student, Lowell Technological Institute, Lowell, Mass. Sponsor: G R Griffin.

Fluorocarbon Finishes———

(*concluded from page 38*)

corporation of different finishing compounds with the fluorocarbons. Some types of water-repellents were found to have synergistic effects upon oil- and water-repellency .

Generally, fluorocarbons were found to have no significant effect upon shade or colorfastness of the dyestuffs tested; and conversely, these dyestuffs were found to have no appreciable effect upon oil- and water-repellency.

ACKNOWLEDGMENTS

American Cyanamid Co
American Fabrics Co, Inc
Arnold, Hoffman & Co, Inc
Carbic-Hoechst Corp
Charles S Tanner Co
Ciba Co, Inc
Cranston Print Works Co
Crown Chemical Corp
E I duPont de Nemours & Co, Inc
General Dyestuff Co
George Mann & Co, Inc
Interchemical Corp
New Bedford Institute of Technology
Owens-Corning Fiberglas Corp
Sandoz, Inc
Sayles Finishing Plants, Inc
Sherwin-Williams Co
Verona Dyestuffs
Warwick Chemical Co

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AATCC Deceased

Member	*Section*
NORMAN J CAMERON Darlington Fabrics, Inc Newton, NJ	Met

AATCC Calendar

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTES

Nov 17-18 (Sheraton-Atlantic Hotel, New York, NY); Nov 17—Council Committees and Research Committees; Nov 18 (AM)—ECR, TCR; Nov 18 (PM)—Council and Annual Meeting

Jan 19-20 (Sheraton-Atlantic Hotel, New York, NY); Jan 19—Council Committees and Research Committees; Jan 20 (AM)—ECR, TCR; Jan 20 (PM)—Council

NATIONAL CONVENTIONS

Sept 28-30, 1961 (Hotel Statler, Buffalo, NY); 1962 (Atlanta Biltmore Hotel, Atlanta, Ga); 1963—Boston; 1964—New York; 1965 (Conrad Hilton Hotel, Chicago, Ill)

DELAWARE VALLEY SECTION

Nov 4, Dec 9 (Philadelphia, Pa)

HUDSON-MOHAWK SECTION

Nov 18 (Chelsea House, Tribes Hill, NY); Jan 13 (Jack's Restaurant, Albany, NY—paper on Nonwoven Fabrics); Mar 10 (Johnstown, NY—paper on "Wash-and-Wear" Fabrics); Apr 14 (Waterford, NY—plant tour of General Electric Co's Silicone Div); May 12 (Ladies Night); June 23 (Outing—Antlers Club, Amsterdam, NY)

METROPOLITAN SECTION

Nov 18 (Kohler's Swiss Chalet, Rochelle Park, NJ—"Importance of L-22 to Converter and Finisher"—Ephraim Freedman, Macy's Bureau of Standards); Jan 20 (Hotel New Yorker, New York, NY—"AATCC Goals"—Ernest R Kaswell, Fabric Research Laboratories, Inc); Feb 17 (Hotel New Yorker, New York, NY—"New Developments in Dye Assistants"—speaker from the DuPont Co); Mar 24 (Kohler's Swiss Chalet, Rochelle Park, NJ—"Polyolefins—speaker from AviSun Corp); April 21 (Kohler's Swiss Chalet, Rochelle Park, NJ—"Importance of Bow and Skew"—Lucille Rea, Simplicity Patterns, and John Robertson, Mt Hope Machine Co); May 19 (Kohler's Swiss Chalet, Rochelle Park, NJ—Ladies Night, "Detergents for Home and Mill"—Dr & Mrs Foster D Snell, Foster D Snell, Inc (tentative)

NIAGARA FRONTIER SECTION

Nov 4 (Annual Business Meeting, Buffalo, NY); Apr 7 (Joint meeting with Ontario Section, CATCC, St Catherines, Ont); May 18 (Buffalo, NY)

NORTHERN NEW ENGLAND SECTION

Dec 9 (Colonial Country Club, Lynnfield, Mass—"Present-day Economic Outlook in Textiles"—William I Kent, Kent Mfg Co); Jan 20 (Hotel 128, Dedham, Mass—Symposium on "Mechanical and Chemical Finishing of Textile Fabrics"—John J MacDonald, Lowell Technological Inst; D D Gagliardi, Gagliardi Research Corp; and Werner von Bergen, J P Stevens & Co, Inc)

PACIFIC SOUTHWEST SECTION

Nov 18 (Rodger Young Auditorium, Los Angeles, Calif); Dec 10 (dance)

PIEDMONT SECTION

Jan 21 (Poinsett Hotel, Greenville, SC); April 2 (Washington Duke Hotel, Durham, NC); June 9-10, 1961 (Outing—Grove Park Inn, Asheville, NC); Sept 23, 1961 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION

Dec 2 (Annual Meeting—Johnson's Hummocks)

SOUTH CENTRAL SECTION

Dec 9 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

Dec 3 (Atlanta Athletic Club, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

Dec 2 (Rapp's Restaurant, Shelton, Conn)

WILMINGTON, DEL———The Subcommittee on Instrumented Methods of the Wash-and Wear Commitiee visited DuPont's Textile Research Laboratory to observe DuPont's new LAP Wrinkleometer for evaluating the smoothness of fabrics. Charles Sylvester, chairman of the Executive Committee on Research, appears at the right of the picture. Building in background is DuPont Country Club, where the subcommittee had lunch.

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OCTOBER OVERTURE
1960

Inter Alia—Inter Nos

P J WOOD

BAA, BAA, BLACK SHEEP

"Among the various branches of the Swiss textile industry", says Ernst Nef, Secretary of the Swiss Wool Industry Association, "that of wool occupies a very important place, not only in the field of economics but also in that of national defense".

This is the opening paragraph of a short article by this writer in a special number of the Revue Textile Tiba, Paris, devoted to an account of the textile industry in Switzerland; it is entitled "La Suisse et le Textile".

Until we read this special number of Tiba, we had no idea of the size of the textile business in Switzerland. Having been in the silk printing business for so many years, we knew about the manufacture of silks in that country--narrow fabrics in Basle, mostly, and broad silks in Zurich and environs, of course, augmented by the valuable information furnished by that world authority, the Ciba Review, so well documented and handsomely illustrated.

A little table of statistical information at the end of Mr Nef's article reveals that there are 90 woolen manufacturing establishments in the country, employing 10,000 workers--146,920 worsted spindles, 96,069 woolen spindles, 68,651 twist spindles--3500 looms. From this machinery they turn out annually 5,000 tons worsted yarn, 4,400 tons woolen yarn, and 4,950 tons of worsted and woolen fabrics.

It has never been possible in Switzerland to raise enough sheep to provide sufficient raw wool for the industry's requirements; in the middle of the 19th century the number of sheep was 400,000, which furnished about 20% of the raw wool required; today, there are no more than 140,000 sheep, so that only 2.5% of the wool used is of Swiss origin. Now, the Swiss import each year more than 10,000 tons of wool of the best quality, for which they paid, before WW2, 35 million Swiss francs; in 1955 they paid 120 millions, and in 1956 about 145 million francs.

The major part of Swiss production in wool goods is used at home. The country has no seaports so it must use and pay for the use of the ships, landing places and railroads of others, which is a bit of a handicap.

MUSIC

This year, the first day of October was Yom Kippur, the Hebrew Day of Atonement, the most solemn day in the Jewish calendar. All day long our Jewish brethren touch not one morsel of food nor one drop of water until the welcome sound of the Shofar notifies the faithful that the day of fasting is over for another year.

On that same date, in the year 1880, John Phillip Sousa assumed the responsibility of leadership of the U S Marine Band, a position he held for 12 years; during that time and later he composed operas, songs and marches.

It is for the marches that he received world renown; he organized Sousa's Band and took it round the world five times; he even invented at least one new instrument, the Sousaphone, which created a sensation wherever it was seen. We believe this giant horn was also known as the Helicon.

Among the marches that he created can be remembered with pleasure such masterpieces as Semper Fidelis, Washington Post March and The Stars and Stripes Forever --whistleable, singable, marchable to the nth degree; and we even remember a dance called "The Washington Post", it was a regular romp. These tunes are immortal, the people will remember them when all the rock 'n' roll and such have been consigned to the limbo of oblivion.

Wasn't it Paul Whiteman who remarked that it wasn't that he had anything against rock 'n' roll, but that he liked music so much better?

It shouldn't be hard to get a seconder for Maestro Whiteman's motion.

KUDOS

On reading an editorial the other day, by our good friend Al McCollough, we discovered that his magazine, Modern Textiles, has reached the ripe age of 35.

Al has been president and publisher of this magazine so long that it seems to us he was always doing this, and yet we must have read the first number of Modern Textiles, but it seems to be longer ago than 35 years.

While we do not expect to go on reading it for another 35 years, which would put us in the age group of Enos, Noah, Methuselah et alia, there will be others that will.

It has been a factor in our post-college education and we have enjoyed it; also it has been good to know Al McCollough, Jerome Campbell, Harvey Williams and Bill Davidson, to mention a few of that congenial crowd.

CHIVALRY

It was the day that "Donna" or that hurricane's residue dropped in on New Jersey and New York.

As luck would have it, we had a luncheon meeting at the Chemists' Club--a meeting of the AIC "Chemist" advisory committee.

In more clement weather we would have taken the bus at Union Avenue, Rutherford in plenty of time to reach the club at 12-on-the-dot, where we were to meet "Mique" Flett, recently retired, Bernie Schaar, less recently retired from Schaar & Co, Bill Sparks of Esso Research and Joe Abere of 3M Co. But as it was so foul we went in by the Erie, a bit late.

The gale was still raging as the train pulled into Hoboken, so it seemed to be the part of wisdom to take the bus to the Port Authority Terminal, where we could get into a cab under cover. The bus was waiting, but a sudden gust of wind turned our umbrella inside out and bisected it successfully into two parts, the cover and the skeleton.

Picking up the mutilated remnants, we made a dash for the bus, where the driver-conductor was trying hard to close the windows. Nearly every seat was wet. We were the only passenger. After a few blocks a mixed group from the Bethlehem Steel Co shipyard crowded in.

The one who sat beside us noticed the umbrella wreck, reached out for it and, with a few deft twists and adjustments, put it back into perfect working shape again --disdaining all hints of reward or even thanks, merely glad to have been of assistance.

No, the spirit of chivalry is not dead.

EAT, DRINK AND STAY MARRIED

Bernadette Massie, the marriage counsellor, has discovered the correct caper for ensuring a happy marital union. After studying who-knows-how-many successful, fair-to-middling and disastrous wedding tries, Doctor Massie has come to the conclusion that the well-nourished, pleasingly plump, or, shall we say, stylishly stout partner seems to be indicated for the long-pull-till-death-do-us-part type of life contract.

Here are some of Dr Massie's own words, as reported by Insider's Newsletter. Says she, "Plump women are seldom involved in crime, automobile accidents, losing their jobs or becoming old maids. Children of happy plump mothers naturally gravitate toward the home and make the home and family the center of their affection and interest".

Some years ago we asked an over-sized friend why it was that fat people always seem to be good-natured. "They have to be", said she, "they can neither fight nor run". It wasn't that she didn't work at her problem of excess adipose tissue--she ate only one meal a day, but it lasted all day.

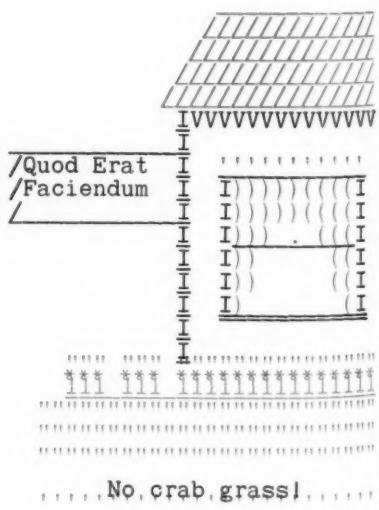
WISE AND WITTY WORKERS IN THE VINEYARD

A short but pithy and interesting letter from Dick Frey of happy memory who is doing an excellent job with Associated Industries of Massachusetts. He is very happy in his work and likes living in Hadley, which all his good friends in the Association will be glad to know.

We just knew that some day, someone would bring out a simpler method of dyeing the acrylic fibers; it is particularly gratifying to learn that the method was developed by our friend of quite-a-while-back Jerry Mecco, who, as everybody knows, has done a lot of outstanding development work in the field of dye application. No abstruse chemical compounds are needed, just the dyer's old familiar friends--salt and acetic. Bravo, Jerry!

"The symptoms of laziness and fatigue" says Mason Dixon in Southern Textile News, "are almost identical and only a few persons can tell the difference; for instance, wives".

Talking to Eddie Duffy of Manhattan Shirt the other day, we remembered to ask him about something that has bothered us for a long time. Every once in a while we get a news release referring to something about "dress shirts"; we always considered this meant a shirt to be worn with a tuxedo or "tails". Eddie said "no". This means a shirt other than a sport shirt. The tux or tails shirt is correctly dubbed a full-dress shirt.



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Abstracts

Printing of Terylene Polyester Fiber and Fabrics

ICI, *Can Textile J 77*, 43-4, August 5, 1960

There are two main methods used in printing Terylene: a normal steaming process, and a dry-heat process. These require different printing recipes and different techniques. The dyes recommended by the authors are selected disperse dyes.

In the steaming process the dye is stirred into a thickening containing "Perminal KB" and "Resist Salt L". The thickener recommended is "Nafka Crystal Gum Supra", which is said to give the most level prints and a high color yield. If desired, an emulsion thickening may be used instead. A final addition of "Tumescal PH" is recommended, to facilitate the diffusion of the dye into the fiber.

After printing, the goods are dried and steamed for one-half to three hours, depending on the pressure (eg, one-half hour at 20 psi or three hours at 5 psi). They are then washed, treated with "Lissapol ND", rinsed and dried.

In the dry-heat process, the dye is stirred into a thickening containing "Perminal KB", "Resist Salt L" and urea. The preferred thickener is "Indalca U", an Italian product, but an emulsion thickening may be substituted.

After printing, the goods are dried and heated to 180-200°C for 40-60 seconds. A 200°C fixation is generally complete after 40 seconds.

Heated tenter frames are used to maintain the dimensional stability of the fabric during the heat treatment, to offset the shrinkage which takes place when relaxed Terylene is subjected to these temperatures. The final washing and drying are the same as in the steaming process.

Selection of the disperse dyes for the dry-heat process is limited to the nonvolatile types.

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The Dyeing of Terylene/Wool Blends

Zinnato, A, *Can Textile J 77*, 51-2, April 29, 1960

This paper deals with the dyeing of blends of Terylene polyester fiber and wool, with the emphasis on piece-goods dyed to solid shades.

Blends range from 55% to 70% Terylene and from 45% to 30% wool. They are being dyed in piece form in winches at atmospheric pressure with a carrier, though they can be satisfactorily dyed in Burlington machines at 225°F with considerably less carrier, and also in yarn form in package machines at both atmospheric pressure and at 225°F.

A considerable amount of Terylene/wool fabrics is presently being produced from tops of the two fibers dyed separately and subsequently blended. In this case the Terylene is dyed at 250°F without carrier. Fabrics so produced will possess the utmost in fastness properties, particularly to light, sublimation and solvent bleeding.

The disperse dyes are used extensively for dyeing the Terylene fibers, with either level-dyeing, neutral-dyeing, chrome or premetallized wool dyes used for the wool component, depending on the shade desired and the fastness required.

Disperse dyes do not actually dye wool, but many of them stain it noticeably. Excessive staining can lead to unsatisfactory fastness properties. Factors affecting the degree of stain are the selection of dyes, the dyeing rate and time, the temperature of the dyebath, the selection of carrier, and the dyeing procedure.

It must be remembered that the wool takes up the disperse dye very rapidly in the early dyeing stage. Considerable time, therefore, must be given to allow these dyes to transfer from the wool to the Terylene and to penetrate the latter fiber sufficiently.

A wide range of disperse dyes is available at present, including dyes particularly developed for the dyeing of polyester fibers. From this group those dyes which transfer substantially from the wool to the Terylene should be selected, particularly in heavy shades.

Dyeing of Terylene with disperse dyes proceeds slowly at 180-212°F. It can be greatly accelerated by addition of a carrier or by raising the temperature to 250°F.

Terylene/wool blends may be dyed by a one-bath method or a two-bath method. If the latter is employed, the Terylene is dyed first, and the wool may or may not be cleared prior to dyeing it in a fresh bath.

The author describes in detail a typical procedure for piece-dyeing a Terylene/wool blend by the two-bath method, using Dowicide A as a carrier.

In dyeing by the one-bath system, the wool dyes are added either before or just after the disperse dyes.

Influence of Fabric Structure on Tear Strength of Resin-treated Cotton Fabrics

Stavrakas, E J, *Textile Bull 86*, 41-2, August, 1960

Research has demonstrated that subtle changes in fabric geometry can improve the tear strength of lightweight, resin-treated cotton fabrics without damaging other properties, changing the basic fabric type or adding cost. Moreover, in certain cases variations in fabric structure can result in greater resistance to tear in a resinated fabric than in its nonresinated counterpart. Similar efforts to improve the tear strength of heavyweight cotton fabrics have not been as successful.

Laboratory studies were made on a variety of cotton fabrics, including ten commercial types and 23 experimental fabrics, all desized, kierboiled and bleached. The tear strength of all, with and without a resin finish, was determined. Following are some of the conclusions reached:

On print cloth, a fancy weave (2×2 basket) is the most effective design feature for improving the level of tear strength.

On broadcloth, filling tear resistance in all resinated experimental fabrics except one was found equivalent to that of the nonresinated control. Significant improvements in tear strength were realized in fabrics with longer floats (3/1 twills) or when weaving with two ends as one (oxford).

On sateen, a fabric of 22/1 warp and 15/1 filling yarn and 120 × 52 threads per inch in the off-loom state and 125 × 50 threads per inch after resin finishing was by far the best of the samples studied. Resin finishing, with one exception, diminished tear resistance.

Contrary to popular belief, scouring often causes a much more serious loss in tear strength than does resin finishing. Removal of the natural lubricants from the cotton by the scouring process results in marked constraints on the ability of the yarn to move in the plane of the fabric. Textile people have taken scouring for granted for a long time—much longer than resin finishing. But if tear strength is the big problem that many feel it is, the author believes that "the scouring process could be a profitable area for concentrated study."

(*Concluded on page 58*)

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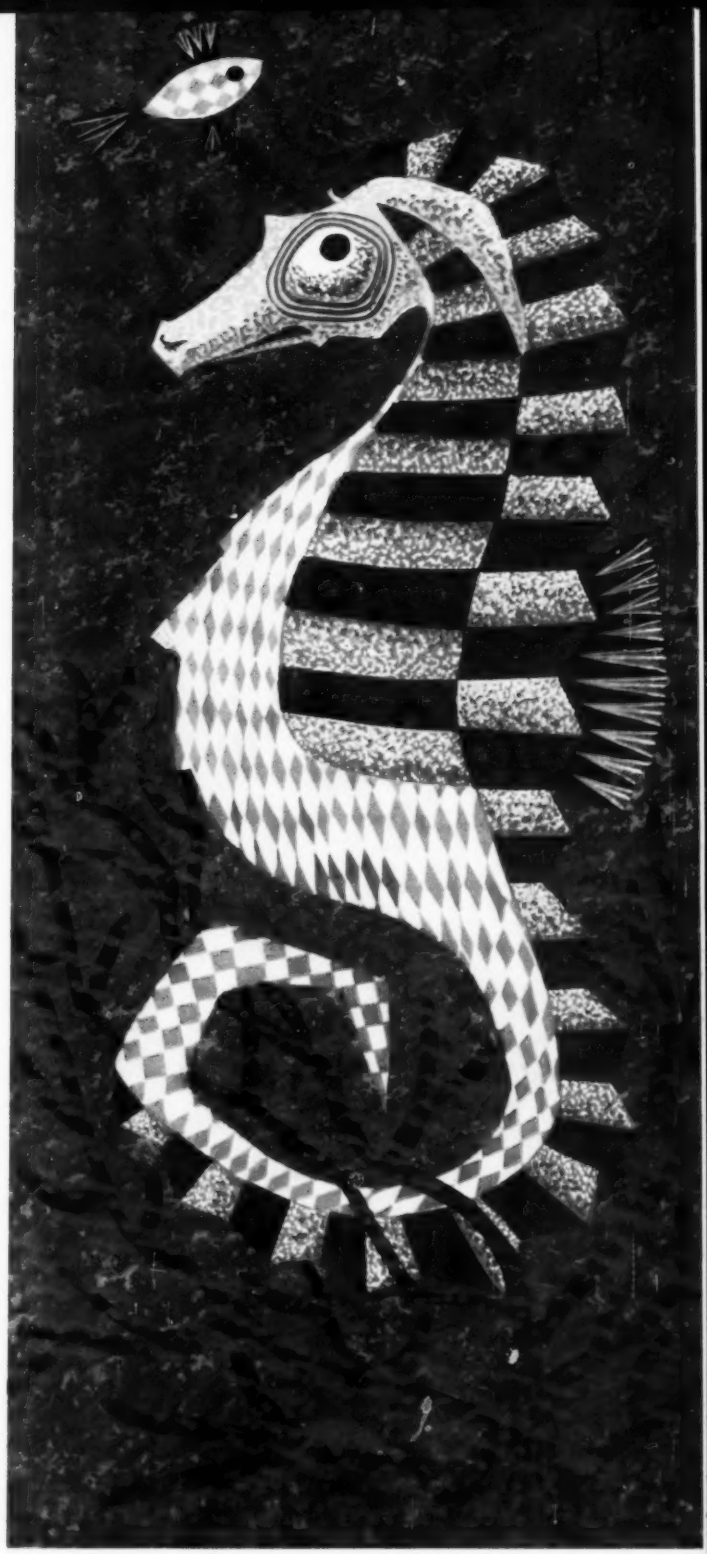


SANDOZ

THINKS AHEAD WITH TEXTILES

SANDOZ

News of the Trade

Fork Lifts Vital in Materials Handling at Rock Hill

Materials handling at Rock Hill Printing & Finishing Co, Rock Hill, SC, is important because of the large areas involved, and to do the job, the company utilizes a conveyor system several thousand feet in total length. Fork lift trucks economically supplement the system in handling various material loading and warehousing situations.

Harold S Auten, who has been with Rock Hill for more than 18 years, serves as maintenance foreman of the plant's 74 lift trucks. Mr Auten and five mechanics comprise the forklift maintenance department.

Loads are not palletized except for cartons stored for export. Loads vary in weight from 500 to 1500 lbs and are stacked to 120". The height of the load varies from three to six feet.

Each truck makes about 250 to 1000 round trips and operates continually around the clock . . . 24 hours daily. They generally do not enter the trailer trucks (carriers).

Among Rock Hill's "fleet" of fork lifts are fourteen Towmotors, products of the Towmotor Corp, Cleveland, Ohio. Of the 14 Towmotors, purchased in 1958 and 1959, there are seven Model #350s; one #420; and two each of the Models #421, #500P, and #410. The Towmotors are used in the shipping department, loading cases to be shipped, and in the warehouse, stock room and white room (white cloth). They operate on cement floors and use no attachments other than the overhead guard. It is estimated that the cost of maintenance and repairs of the Towmotors has been about $40-50 for trucks two months to two years old. Overall average has been about $46.50.

Rock Hill Printing and Finishing Co, a division of M Lowenstein & Sons, was founded in 1928. Rock Hill is the original site. Employing over 4000 people and producing over 500,000,000 yards yearly, the firm, which is reputed to be the largest textile printing plant in the world, is engaged in bleaching, dyeing, printing and finishing of cotton and synthetic textiles on a five-and-one-half day week basis. Its distribution is international in scope.

•

Theme Chosen for AATT's Annual Meeting

"The Challenge of Modern Fiber Technology" will be the theme of the annual meeting of the American Association for Textile Technology to be held as an all-day conference at the Hotel Commodore, New York, NY, on February 8, 1961, according to an announcement by Cameron A Baker, president. This will be the first annual meeting of AATT under its new constitution, adopted early this year, which provides for the operation of chapters and an expanded program of activities.

Kurt J Winter, vice president of AATT and chairman of the Technical Council, said the Council chose this theme because of the impact of an increasing number of new fibers and fiber modifications on all textile interests from the producer to the consumer. He said that close to 1000 different names are in use to describe the world's current output of natural and man-made textile fibers and the number is increasing. It was stated that new responsibilities for the proper use and processing of these fibers in all types of fabrics to achieve satisfactory performance and consumer acceptance of the final product, as well as new responsibilities in merchandising promotion and consumer education, have combined to create a very real challenge for everyone concerned.

The conference program will have two main objectives: 1) to help eliminate confusion brought on by the rapid expansion in fiber technology and an increasingly more complex fiber terminology; and 2) to clarify the responsibilities of producers, processors, distributors, consumers, launderers and drycleaners in the use of new and improved fibers and their end products.

The meeting will be open to all members of the textile industry. It will feature a series of four panels covering the following broad areas of interest: retailing, fabrication of end products (apparel, industrial, home furnishings), converting, and mill operations. A speaker will outline the effect of fiber growth in each special area and panel members will be drawn from related fields in order that the broadest possible point of view will be represented in the discussion.

Albert E Johnson, a director of the lations for the National Institute of Drycleaning, has been named general chairman of the meeting. The administrative chairman will be Erb Ditton, a former president of AATT and a textile consultant.

•

USDA Reports New Treatment That Shrinkproofs Wool Fabric

U S Department of Agriculture scientists have discovered a new treatment that shrinkproofs wool fabrics and makes them safely washable in machines.

Their discovery is essentially a way to cover wool fibers with an ultrathin coating of a polyamide that is chemically similar to one type of nylon. Treated fabrics retain wool's natural soft texture and yet wash without shrinking and dry without wrinkling.

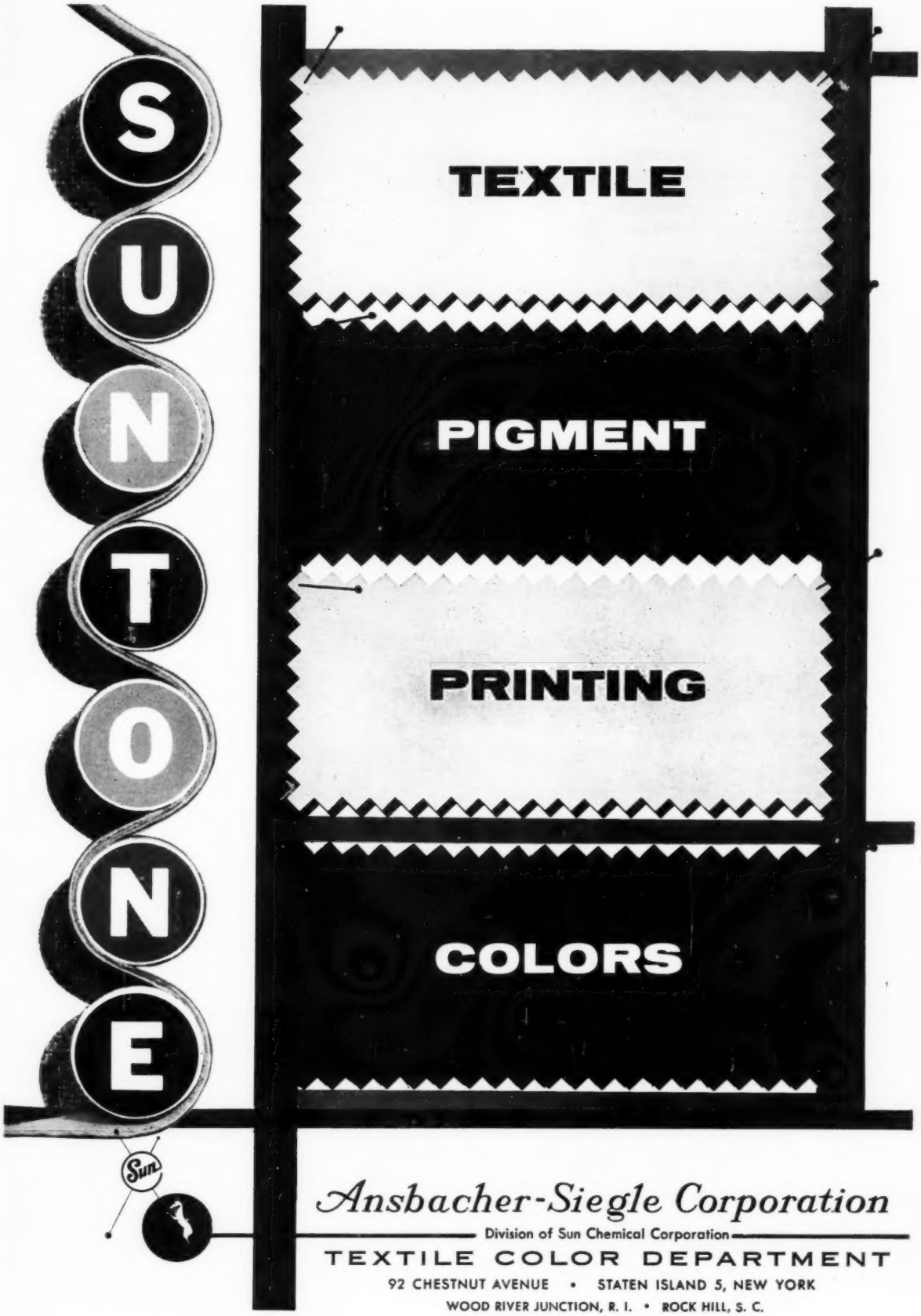
The new treatment can be combined with USDA's recently announced ethanolamine method for putting permanent pleats and creases in wool fabrics. It differs, however, from the shrinkproofing treatment previously reported, in which modified epoxy resins are used.

The new approach to wash-and-wear wool is a development of the Western Regional Research Division of USDA' Agricultural Research Service in Albany, Calif, the same laboratory that developed the resin and ethanolamine treatments. Chemists responsible for the polyamide treatment are W L Wasley, R E Whitfield, L A Miller, and W Fong.

Using a reaction well known in chemical research called interfacial polymerization, these chemists immerse wool in a dilute solution of a diamine and then immediately draw it through a dilute solution of diacid chloride. Under suitable conditions, a very thin and extremely durable polymer film is formed on the surface of the wool fibers.

The researchers say the film is so thin that it increases fabric weight as little as one percent or less. Commercial equipment should be suitable for the application. Following treatment, the fabric is simply rinsed in water and dried. No heat curing is necessary.

In laboratory tests, the new treatment has proved successful for shrinkproofing wool suitings, knitted wear, blankets, and other wool goods. Treated garments endure repeated machine washing, drycleaning, and wear stress with superior retention of dimensions, colors, softness, and resilience. The treatment may find application also as a coating for materials such as other natural fibers and paper.



Ansbacher-Siegle Corporation

Division of Sun Chemical Corporation

TEXTILE COLOR DEPARTMENT

92 CHESTNUT AVENUE • STATEN ISLAND 5, NEW YORK

WOOD RIVER JUNCTION, R. I. • ROCK HILL, S. C.

Corlin Processing Co—All-new $3/4 Million Package Dyeing Plant

The new $750,000 package-dyeing plant of Corlin Processing Co at Landis, NC, a joint venture of Linn Mills and Corriher Mills Companies, has been designed to enable diversification of the ultimate end uses of the mills' products by entering the dyed yarn field for the first time in sixty years of existence.

The move, first considered 30 years ago, was re-considered in 1948, but not until last year, when Landis built a modern sewage-disposal plant and a 100,000-gallon water tower, did the plant become economically feasible.

As mayor of Landis, Linn Mills' President Frank Lipe virtually "carried water on both shoulders", but when the city fathers were told of the advantage the new plant would offer in additional annual income from the water system ($12,000), taxes ($4,000) and wages ($200,000), they voted unanimously for the project.

The plant's straight-line production, a continuous one-way flow of yarn from spinning machines through the dyehouse to the ultimate consumer, is said to eliminate back-up to provide some of the fastest customer service in the industry.

Yarn is wound onto dye tubes at the mills, loaded in self-contained pallets and trucked across town to Corlin Processing, where it is dyed, dried and moved to the winding room, within the dyehouse, for backwinding, packing and shipping direct to the customer.

The flexibility of Corlin's machinery arrangement reportedly permits production of dye lots ranging from 200 to 1,500 pounds of yarn in a single dyebath, with correct shade and level dyeing throughout any given batch.

In a central chemical mixing room on the mezzanine, dyestuffs and chemicals are combined and fed directly, as needed, through overhead glass tubing to the dyeing machines. A signal light and intercom system allows instantaneous communication between dyer and mixing room.

View of Corlin Processing Co, Landis, NC

Modern and complete dyeing equipment is available. The machines, which are said to incorporate the most advanced design features to assure quality dyeing, are designed for working pressures to 85 psi and temperatures to 350°F.

L to r: Fred Corriher, board chairman; Lane Drye, secretary-treasurer; Frank Lipe, president

Robert Hundley, plant manager at Corlin

A completely equipped laboratory provides adequate means for matching shades and producing dye lots up to 15 pounds to assist stylists and designers in development work before seasonal demands require large production batches of yarn. Corlin considers this a most important phase of its customer service.

Drying equipment consists of the latest-type static-pressure rapid dryers, which reportedly assure fast delivery of orders once shades have been established and approved. Drying has been a bottleneck in many dye plants. Corlin is said to have avoided this problem by installing efficient and fast drying machinery and by providing excess capacity beyond actual requirements.

All dyeing and drying machinery was produced and installed by Gaston County Dyeing Machine Co, Stanley, NC. Instruments for the machinery were provided by The Foxboro Co. Electrical equipment was made by Allis-Chalmers Mfg Co.

Exterior of the new building is of red jumbo brick and the interior of concrete block. The rear wall is constructed of insulated aluminum panels to permit future expansion. It is said to be extremely well-ventilated and lighted.

Corlin Processing Co, the name of which is a combination of Corriher and Linn, is a separate corporation of which J Frank Lipe is president; Lane Drye, secretary-treasurer; J Fred Corriher, chairman of the board; and Robert Hundley, plant manager.

L P Muller & Co, Philadelphia, is the selling agent for Corriher, Linn and Corlin Processing Co.

Interior views at Corlin Processing Co show modern package-dyeing equipment and instrumentation

Lab at Corlin Processing is vital to customer service

R & H Announces Price Change for Alkylphenols

A price advance of one-half cent a pound in all quantities of alkylphenols, effective October 1, has been announced by Rohm & Haas Co. The bulk price for octylphenol will be 21½ cents a pound, and nonylphenol and dodecylphenol will each be 20 cents a pound in bulk quantities.

•

Price Reduction on PVP/VA Copolymer

A substantial price reduction was announced this month by Antara Chemicals, a sales division of General Aniline & Film Corp, for its vinyl-pyrrolidone/vinyl acetate copolymer, PVP/VA W-464, a 40% aqueous emulsion.

Since its introduction about six months ago, this stable latex reportedly has found increasing application in several fields. The product is said to be emulsifier-free.

The new price schedule starts at 50 cents per lb in T/C or T/Tr quantities. PVP/VA Copolymer W-464 is one member of a series supplied in several monomer ratios as well as in different physical forms.

Other PVP/VA copolymers are available from Antara in solid form and as 50% solutions in ethanol as well as in isopropanol (for general industrial uses). Each product is said to be a distinctive film former which is adaptable to aqueous or organic solvent systems. Their properties are described in detail in a 20-page brochure available on request from the Acetylene Chemicals Department of Antara Chemicals, 435 Hudson St, New York 14, NY.

•

Synthosize

A new warp size for synthetic filament yarns, recently announced by Morningstar-Paisley, Inc, New York, NY, reportedly offers lower cost and improved specific adhesion to cellulose acetate, triacetate, and polyester fibers. The product, called Synthosize, is based on a resin copolymer. The combination of high solids content and excellent adhesion is said to aid in obtaining extremely high weaving efficiency.

Synthosize reportedly can be readily removed by usual scouring methods in a mildly alkaline solution. It is said to cost less per dry pound than other types of sizes: for example, about 20% less per dry pound than 100% acrylic products.

A typical size bath for acetate filament yarn would be 60 lbs Synthosize in 100 gallons total volume. For low twist polyester yarns, a formula of 75 lbs in 100 gallons is used.

Synthosize is supplied as a concentrated liquid. In the size bath, it is diluted to approximately 6 to 8 percent solids. Further information may be obtained by writing Textile Dept, Morningstar-Paisley, Inc, 630 W 51st Street, New York 19, NY.

General Dispersions to Move

On or about November 7th, General Dispersions Inc will be located in its new plant at 55 La France Avenue, Bloomfield, NJ.

The company will continue to produce a line of nylon dispersions and solutions for fabric finishing. They are also used to bond thread and twine. A new product, Gental 1075, reportedly has been developed to prevent the fraying and seam-failure common in "wash-and-wear" fabrics.

General Dispersions markets aqueous dispersions of Du Pont's Zytel 61 nylon under the trade name of Genton and alcohol-based solutions designated as Gental.

•

PTI Entering Class Largest in Eleven Years

Philadelphia Textile Institute has registered 154 new students, 143 freshmen and 11 transfers who entered for this fall semester.

It is the largest entering class in 11 years and represents approximately 50% increase over other entering classes since that time.

Mott Linn, director of admissions, stated, "The jump can probably be attributed to the increased facilities at the College along with its more diversified curriculum and the excellent student-faculty ratio."

The new entering students combined with 236 returning students gives PTI a total enrollment 390, its highest total enrollment since 1952, compared with the total enrollment of 335 this time last year.

Of the freshman class, 129 are from the United States and 25 are from foreign countries. Of the total of 390, 320 are from this country and 70 from 23 foreign countries.

Divided by courses, the new class was: 70 in the management and marketing program, 20 in the chemistry program, 20 in the fabric design program, and 30 in engineering.

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RETARDER O CIBA

Outstanding leveling agent for cationic dyes in dyeing acrylic fibers

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offers superior retarding action in the critical temperature range between 195-212°F.

RETARDER O insures a high degree of exhaustion in the critical temperature range of between 195-212°F. This cationic, aqueous solution can be added straight to the dyebath. RETARDER O is highly efficient and economical to use. Let us send you the technical folder describing RETARDER O in detail. CIBA Company Inc., Chemical Specialties Division, Fair Lawn, N. J.

CIBA WHERE RESEARCH IS THE TRADITION

US Matching European Dye Research

The European textile industry is running neck-and-neck with the U S on basic dyeing and dyestuff research, according to Dennis P Riley, president of Interchemical Consultants, Inc, Geneva-based advisory firm. Dr Riley's remarks came as latest U S developments in textile dyeing and finishing were being highlighted at the AATCC national convention at the Sheraton Hotel, Philadelphia.

Basing his observations on a just-completed survey of European dyeing research, Dr Riley said, "A most interesting aspect of our findings is that no blanket assessments can be made. Some European laboratories are ahead of the US work in similar areas. Other European work is behind the US. In general, however, the race is about tied."

Great Britain and Germany are the two strongholds of research, said Dr Riley, with Great Britain concentrating on physical chemistry while Germany has more interest in chemical reactions concerned with dyeing. The most widely investigated substance is cellulose, followed closely by wool.

Polyamides are being increasingly studied, but polyesters and polyacrylonitriles, except in a few special cases, are largely being neglected. "Neither polyvinyl or polyolefine fibers have been really looked at in Europe yet," said Dr Riley, "but some of the associated research reported in our study looks very interesting."

The Intertechnical survey was undertaken for an undisclosed number of dyestuff producers, fiber manufacturers, and mills in the US, Europe, and Japan. It included first-hand visits to 30 laboratories in six major countries: France, Germany, Great Britain, Holland, Italy, and Switzerland. Present industrial practice and significant industrial trends in Great Britain, Germany, and Switzerland were also pinpointed.

Concluded the consultant, "Leading US dyestuff manufacturers, fiber producers, and mills cannot afford to relax basic research. In at least a few key areas, Europe is already ahead."

•

2nd Phase in Kodel Production Started

The second phase in the multi-million dollar construction program of production facilities for Kodel polyester fiber has been started at the Tennessee Eastman Company division of Eastman Kodak Co. Tennessee Eastman, located in Kingsport, Tenn, is the second largest manufacturing unit of the Eastman Kodak Company and is a major producer of chemicals, fibers, and plastics.

Coming off the drafting boards of the company's engineering division are construction and equipment plans for two new plants—one for the manufacture of terephthalic acid and the other for dimethyl terephthalate. "The plants will be of sufficient size to meet our Kodel manufacturing requirements for these two chemicals. The units will also have capacity available to supply Kodak Park Works with dimethyl terephthalate for the production of Estar, a polyester resin film base," Eastman officials said.

The new plants at Tennessee Eastman reportedly will be modern unenclosed chemical production units. The control rooms, warehouses, and personnel quarters will be of brick and concrete. Work is now underway on the installation of underground utility service lines. The projects are scheduled to be completed during the latter part of 1961.

Eastman officials also reported construction is in the final stage of the main Kodel plant, which will have a production capacity of approximately 20,000,000 pounds annually. It is expected that the first units of the Kodel plant will be put in operation during the fourth quarter of this year. Construction was started in June, 1959.

•

Solvay to Double Facilities at Syracuse Service Lab

A major expansion, which will approximately double facilities at the Syracuse, NY research-technical service laboratory of Allied Chemical's Solvay Process Division, has been announced by W H Brumfield, Solvay's president.

Work on the project will begin immediately with occupancy scheduled for late next year. The laboratory expansion will provide enlarged facilities for Solvay's technical service and market research divisions.

Annual allocations by Solvay Process for research have tripled within the past 10 years. In the same period, the professional, technical and administrative staff has been doubled. Additional personnel required will bring the research group to approximately 230.

The new facilities will allow an expanded program of research in such areas of chemical technology as new high-temperature uses for chromium chemicals, as well as propylene oxide polyethers for urethane foams and other applications. Also included in the program will be extended research in the organic chemistry of hydrogen peroxide.

Solvay's research-technical service laboratory is adjacent to the Division's largest plant at Syracuse. Other Solvay plants are located at Baltimore, Md; Baton Rouge, La; Brunswick, Ga; Detroit, Mich; Moundsville, W Va; and Ransomville, NY.

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NEW PRODUCTS, DEVELOPMENTS, PROCESSES

Prestwick

A permanent, nonresin, "wash-wear" finish which puts rayon and rayon/cotton blend fabrics in a completely competitive position with all other "wash-and-wear" fabrics is now claimed by Courtaulds, Inc. The finish, called Prestwick, has so far been applied commercially only to spun rayons, but extensive trials which have been carried out reportedly suggest it will be equally effective on cotton, continuous filament rayon and the newer man-made cellulosics, as well as blends of cellulosic fibers with thermoplastic fibers. The finish has been under plant development since the latter part of 1958, following experimental work in the Company's Alabama Laboratories.

Prestwick is said to have outstanding dimensional stability on both rayon and cotton fabrics. It reportedly has proved possible to compressively shrink fabrics treated with Prestwick to a residual shrinkage of less than 1% in both length and width. A rayon garbardine is currently being marketed under the Sanforized mark. Prestwick, on both piece goods and in test garments, has withstood fifty complete cycles of automatic "wash-and-wear" launderings, under typical home laundry conditions, it is claimed. With soundly constructed fabrics, the abovementioned properties reportedly are obtained together with good tensile strengths, tear strengths and abrasion resistance.

Prestwick fabrics are said to have good crease recovery both wet and dry, and excellent "wash-and-wear" ratings reportedly can be obtained. It is stated that process permanently modifies the cellulose fibers to which it is applied; consequently, crease recovery, "wash-and-wear" properties and dimensional stability are maintained for the life of the garment regardless of the number of times it is washed, and regardless of washing methods whether at home or in commercial launderies. It is claimed that the finish has no chlorine retention, and fabrics qualifying for the Prestwick mark can be sold as unconditionally washable.

Courtaulds will license the process for use on both rayon and cotton, and permit the use of the Prestwick trademark on fabrics conforming to Courtaulds quality standards. Such fabrics will be extensively advertised in the trade and supported by hangtags.

United Merchants & Manufacturer, the first licensee of Prestwick, has been in commercial production since May 1st and reportedly has successfully processed over one million yards of spun rayon fabrics. Trials are now in progress with United Merchants and a number of other finishers on a wide range of rayon and cotton fabrics commonly used in apparel and home furnishings.

Edwin Berliner, recently with United Merchants & Manufacturers, Inc in its Finishing Division, will join the Staff of Courtaulds within the next month to coordinate the licensing program on Prestwick.

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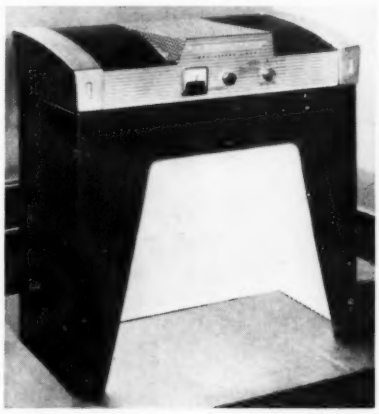
Gamain Generator

Accurate comparison of colors and color identification reportedly can be accomplished with a new, scientific ally engineered instrument designed for this purpose by the Gamain Co, 5th and Richmond Sts, Kansas City, Kas.



Model 6000 Gamain Generator

The Gamain Generator is designed to reconstruct natural daylight so that colors can be correctly appreciated or compared under a light which possesses all the daylight radiations in proper proportions, quantities and qualities, it is claimed.

The spectral distribution of daylight is said to be applied accurately to all of the various light sources available with the new generator. These light sources are accomplished by use of incandescent, blue fluorescent, daylight fluorescent, and color filters which are all blended by manual control to duplicate the desired type of artificial daylight. Black light (ultra-violet) is also used to check the quality of bleach of white materials and for inspection of materials treated to fluoresce.

With the many variations of artificial light that can be produced by the Gamain generator, colors can be compared for color matching and for appearance in artificially lighted installations as well as in natural daylight.

A Chemical Specialty Development of CIBA

UVITEX A Double

Nonionic, lightfast optical brightener for Orlon* and other acrylic fibers

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UVITEX A Double

produces high, neutral whites...of unexcelled lightfastness.

UVITEX® A Double is applied by the exhaust method. This brightener is stable to chlorine and applicable from acid chlorite bleaching baths. UVITEX A Double is also used in the dyeing and brightening of pastel shades. CIBA Company Inc., Chemical Specialties Division, Fair Lawn, N. J.

CIBA WHERE RESEARCH IS THE TRADITION

• NAMES IN THE NEWS •

Wechsler

Ralph Wechsler, chairman of the board of Nopco Chemical Co, was honored recently at a testimonial dinner marking his retirement from the company after almost 40 years of service. Over 200 employees attended the dinner at the Down Town Club, Newark, NJ, and presented him with a set of golf clubs.

Mr Wechsler joined Nopco as a chemist in 1921. He later served on the board of directors and as treasurer of the Company. He was president of the firm from 1955 to 1959 and will continue as chairman of the board.

One of the early members of the company, Mr Wechsler was responsible for much of its progress. He directed the company's acquisition of its European plants and placed Nopco on the New York Stock Exchange.

He resides on Devon Road, Essex Fells, NJ.

•

Harold G Shelton and *Edward J Williams* have been elected vice presidents of General Aniline & Film Corp by its board of directors.

Mr Shelton was recently appointed group executive in charge of the chemical, dyestuff and pigment operations of the company.

In his new position, Mr Williams, who was formerly the administrative assistant to the president, will be concerned with corporate financial planning and control.

•

Food Machinery and Chemical Corp has added *John Ager Jr, John Kolyer* and *William L Riedeman* to the organic department of its Chemical Research and Development Center at Princeton, NJ. They will be engaged in the synthesis program of the department.

Dr Ager was formerly senior research chemist with Olin Mathieson Chemical Corp. Dr Kolyer has done extensive work in model enzyme systems, while Dr Riedeman's chief work has been in the synthesis of nitrogen heterocyclics.

Sage

Marvin W Sage has been named technical director of Hodag Chemical Corp, Skokie, Ill, manufacturer of surface-active chemicals.

Dr Sage will be responsible for overall supervision of laboratory operations, including research and product development. He was formerly a research director at the Van Straaten Chemical Co, and application research leader in the Central Research Department of Armour & Co.

•

Hill Top Research Institute, Inc, Miamiville, Ohio, has appointed *John R Elsea* as director of toxicology, effective Sept 1. Dr Elsea was formerly with Hazleton Laboratories. Hill Top, located in suburban Cincinnati, offers diversified services in the biological field, including toxicology, bacteriology, human patch test and clinical studies, and product evaluation.

•

Pennsalt Chemicals Corp's Industrial Chemicals Division has appointed *C Robert Geiser* as manager of product development, in which post he will be responsible for developing new markets and uses for existing products as well as analyzing the market potential and developing markets for Pennsalt's new industrial chemical products.

Succeeding Mr Geiser as product manager with headquarters in Philadelphia is *Robert O Rowe.* In his new post, Mr Rowe, who was formerly assigned to the Division's Cleveland sales territory, will supervise sales for such products as amyl alcohols and acetates; alkyl and alkylol amines; hydrocarbons and olefins; and ureas and thioureas.

•

Appointment of *Alfred E Jones* to the position of assistant director of procurement of Koppers Co, Inc, has been announced.

Mr Jones joined Koppers in 1941. Last March, he was named manager of the Plastics, and Chemicals and Dyestuffs Sections.

Rauh

Edward Rauh, sales representative for Colton Chemical Co in Ohio, Michigan and Indiana, has been transferred to California. Rauh will be assigned to the Los Angeles office, 3409 Medford St. Colton Chemical Co, a division of Air Reduction Co, Inc, is headquartered in Cleveland.

Colton Chemical manufactures synthetic resins for the textile and other process industries.

•

Otto B May, Inc has announced the appointment of *George O Linberg* as sales consultant for the New England district. *Earl Holton* of the sales staff of Otto B May, Inc has been assigned to Mr Linberg for technical service work in connection with May's expanded sales program in the New England area.

Mr Linberg, a past president of AATCC, will continue to serve Mel-Rose Chemical Co as executive vice president.

•

When an Electra jet-prop crashed into Boston Harbor on October 4 killing 61 people, it claimed the lives of two rubber roll technical men from Stowe-Woodward, Inc.

On their way to the firm's Griffin, Ga, plant were *William H Mordo,* technical service manager, and *N Warren Hess,* senior chemist.

•

Petro-Tex Chemical Corp has appointed *Heinz G Friedrick* and *Joseph H Finley* to the section of its research department located at the Chemical Research and Development Center of Food Machinery and Chemical Corp at Princeton, NJ. Petro-Tex is equally owned by FMC and Tennessee Gas Transmission Co.

Mr Friedrick is engaged in long range exploratory research with emphasis on heterogeneous catalysis.

Mr Finley is working on long-range exploratory research on petrochemicals.

Petro-Tex' principal products are butadiene, butene-1, butene-2, butylene, isobutylene, diisobutylene, triisobutylene, and alkylate.

Paul A Koppe Jr has been appointed plant manager of the Rockford Textile Mills, Inc, McMinnville, Tenn.

In this capacity Mr Koppe will be responsible for the manufacturing activities and direction of all practices, procedures, and quality of the products produced by this company including casual sport socks.

Mr Koppe has had over 20 years experience in textile mill management serving in capacities such as superintendent, technical supervision of designing and fabricating, quality control director, and plant manager. Since 1958 he has been serving on the management staff in quality control and other staff activities of the Peerless Woolen Mills, Rossville, Ga, and has resigned to accept this new assignment at Rockford.

In this new position Mr Koppe will coordinate activities that have been previously handled by *James Embry*, plant engineer, and the president's office. Mr Embry will continue in the capacity of plant engineer and superintendent of shipping and receiving.

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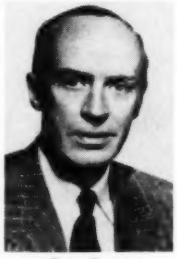
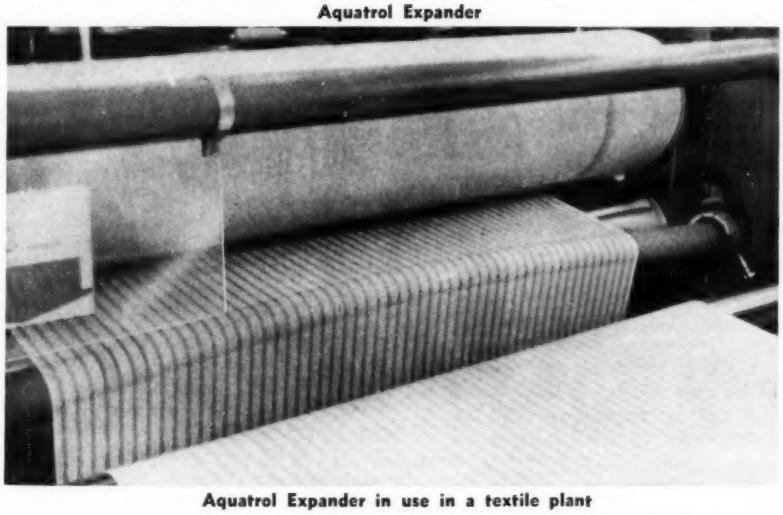


Du Pont

James Q Du Pont, administrative assistant in the Public Relations Department of E I duPont de Nemours and Company, Inc, Wilmington, Del, addressed the student body of the Philadelphia Textile Institute in the auditorium of Althouse Hall on October 3.

In his talk, "Pattern for Success," Mr Du Pont developed the ten basic points on the "business compass".

Aquatrol Expander



Aquatrol Expander in use in a textile plant

Aquatrol Expander

A new principle of operation has been incorporated into a bow expander roll introduced by Rodney Hunt Machine Co, Orange, Mass. Called the Aquatrol Expander, the new Rodney Hunt roll uses a thin film of water as a bearing, reportedly eliminating bearing maintenance and failure. US and foreign patents are pending.

With only one moving part, this new roll reportedly has very nearly frictionless rotation. This single moving part is a rotating rubber sleeve. It is claimed that the secret of the design is that the sleeve floats on a film of water to give uniform, smooth, even spreading action over every increment of face width.

Several leading textile and paper mills are said to have been using the Aquatrol Expanders with satisfactory results.

For additional information, contact Rodney Hunt Machine Co, Industrial Roll Div, Orange, Mass.

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Terriss Stainless-Steel Scouring Pads

Stainless-steel scouring pads are now being marketed to industry for the cleaning of equipment. They are available in three sizes— utility, laboratory and industrial. The soft but firm texture is said to easily remove dirt, grime, discoloration and foreign matter without injury to the hands of the user. They are claimed to be washable, rustproof, durable and long lasting. An introductory sample packet containing one each of 2½", 3½" and 4¼" dia pads is available for $1.50 postpaid, from Terriss-Consolidated Industries, 22 Wooster St, New York 13, NY. Detailed literature and quantity prices are available from the firm upon request.

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Abstracts———

(*concluded from page 48*)

Shrinkage of Textile Fabrics

Whewell, C S, *J Textile Inst 51*, 172-3, March, 1960

The author points out that cloth shrinkage is of itself a desirable property. He explains how, by the release of fiber and yarn strains during the wet-processing of a fabric, cover and fullness can be obtained. The real requirement is to be able to stop all further shrinkage substantially after making use of this property in the wet-processing.

Solvent scouring of wool has no shrinking effect, and must be followed by a wet treatment to obtain the desired finish.

Milling shrinkage occurs when a fabric containing wool is subjected to mechanical treatment in presence of soap or acid. In general, blends of wool with other fibers shrink less in milling than all-wool fabrics, but in a few cases the opposite is true. Blends of wool and Terylene or acrylics are milled to obtain cover and fullness in what would otherwise be "lean" fabrics. Viscose rayon fabrics of certain structures also shrink substantially when washed vigorously in soap.

The author analyzes the causes of further shrinkage in fabrics after they have been finished. He states that an acceptable standardized test for measuring shrinkage in the laboratory is badly needed. Machinery should be designed which will reduce the stretching of cloth during processing to a minimum.

The various processes used for stabilization of shrinkage in wool fabrics are described, with particular emphasis on "London shrinking". There is also the alternative possibility of using a "modified blowing process" in the final stage, perhaps with the application of sodium bisulfite or thioglycollate.

For stabilizing viscose fabrics the combined use of compressive shrinkage with a resin treatment appears to be an important development, he says.

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Problem of Synthetic Fibers in the Processing (Dyeing) of Recovered Wool

Lee, J G, *Dyer 123*, 59-61, Jan 1, 1960

The problem of the occurrence of foreign fibers has always been present in the recovered wool industry. Originally, the other fibers were cellulosic in nature (ie, cotton, linen and straw). These fibers are either removed by carbonization or covered by cotton dye.

Since 1920, a large number of different fiber types have appeared, and many of these are widely used in unions with wool. The problem of dyeing recovered wool now requires special precautions:

1) More care is necessary in the original sorting of the material to ensure that synthetic fibers do not stray into recovered wool which will be made into cloth and piece-dyed.

2) If synthetic fiber does get into the woolen pieces, it must be detected before dyeing and its dyeing properties identified.

3) The dyeing technique used must be adapted to color the synthetic fiber.

On certain cloths, synthetic fibers may show even if they are exactly the same shade as the wool, due to greater reflectance from their smooth surface.

Perhaps the most troublesome are the union cloths, particularly wool/Terylene, since these may easily be confused with all-wool suitings. Synthetic fibers in linings are still mainly acetate, but Terylene is used as an interlining for lapels of coats, etc, and Terylene sewing thread is also on the market. It is obviously easy for these fibers to be introduced into the wool material which is going for recovery.

The author suggests several tests that the dyer should use if he anticipates trouble. If a dye test on a sample of the goods, made with an acid dye, shows white specks, the undyed fiber should be identified. Three tests are suggested: burning the fibers and examining the ash, microscopical examination, and a staining test. For the latter, acid, basic, disperse and direct dyes are applied to the unknown fiber in test-tubes, together with known samples of various synthetics. This test should readily show which kind of a fiber the unknown is.

The author offers practical suggestions for covering the various synthetic fibers when found in recovered wool. He considers that success is possible in all cases except the heavier shades containing Terylene, which he says are "the nightmare of the piece-dyer."

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Shrinkproofing Textiles with Polyamides

Trusselle, W C J, *Fibres & Plastics 21*, 12-13, Jan, 1960

Many textile fibers exhibit poor dimensional stability, a typical example being the severe shrinkage of wool when washed. Many of the known methods of overcoming this problem have the disadvantage of impairing the hand of the fabric.

A recent American patent (to Cray Valley Products Ltd) describes a novel process for shrinkproofing and feltproofing textiles by impregnating the material with a polyamide and subsequently curing with a polyepoxide. It is claimed that the process yields a product which is virtually shrinkproof under normal laundering, while resiliency, porosity, and tensile strength of the textile are substantially unaffected. Furthermore, the treated textile has increased resistance to creasing and wrinkling compared with the original.

The polyamides employed for impregnation are those derived from aliphatic polyamines and polybasic acids. Products containing free amino groups, free carboxyl groups, or both may be used, but those containing free amino groups have been found to work best because the active hydrogen atoms on these are particularly reactive towards epoxide resins.

Although polyamides based on adipic acid (ie, the well-known super polyamides) can be used for the impregnation, those derived from polymerized fatty acids have been found to give the best results due to their solubility in the more common solvents. They also impart better flexibility to the fabric.

The polyepoxide most commonly used for curing the impregnated textile is butadiene dioxide (1,2,3,4-diepoxybutane). Volatile polyepoxide ethers (eg, diglycidyl ether) are also suitable.

The polyamide in the form of an emulsion or solution is applied to the textile by any suitable method. The fabric can then be cured at once, or preferably dried first (at 65°C). Curing is effected by passing the material continuously through a chamber containing the volatile polyepoxide. The amount of polyepoxide vapor in the chamber may be increased by the application of heat, vacuum, or both. Sufficient vapor must be present to satisfy completely the polyamide resin used. Actual tests have shown that zero area shrinkage after laundering was obtained with a 2.8% pick-up of polyamide which increased to 3.95% after curing.

Although the above treatment is particularly adapted to the treatment of wool, it may also be applied to other textiles, including cotton, cellulose acetate, protein fibers and linen.

The original color of the textile is unimpaired, while wool retains its white color, and dyed woolen textiles are undiminished in brightness.